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MEASURING INSTRUMENTS FOR OPTICAL FIBER COMMUNICATIONS SYSTEMS

1988

Anritsu

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Anritsu

MEASURING INSTRUMENTS FOR OPTICAL FIBER COMMUNICATIONS SYSTEMS

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How to Use This Catalog

■STANDARD PRODUCTS

All measuring instruments for optical fiber communications systems appearing in this catalog are of standard. For information on other than standard instrument please feel free to contact us.

■NEW

Identifies newly developed and introduced products in the term from July 1985 to July 1986.

■MEASURING INSTRUMENTS WITH GP-IB

Measuring instruments whose pictures of external view are marked with 《GP-IB》 can be integrated into a system with GP-IB.

■SPECIFICATION CHANGES

We reserve the right to discontinue any item without notice and to change specifications at any time without incurring any obligation to incorporate new features in instruments or parts previously sold.

■ACCESSORIES

Two types of accessories are available: Supplied and Optional. All instruments include the cost of accessories supplied including fuses of 100%, and one instruction manual in English. The cost of optional accessories, however, is not included and therefore the optional accessories will be supplied on request.

■NUMERICAL VALUES USED IN THIS CATALOG

All numerical values are expressed according to the following units:

- **Power supply voltage**
  Normal operation is obtained within ±10% of specific voltage supplied from 100V (or 220V), or any optional power requirements of between 100V and 250V which can be met upon your request.
- **Ambient temperature, rated range of use**
  "Ambient temperature, rated range of use" in the specifications represents the range of ambient temperature which guarantees the values given in the specifications.
- **External dimensions**
  External dimensions are indicated in height, width, depth in millimeter, and do not include knobs, fittings or stands. (see Fig. 1)

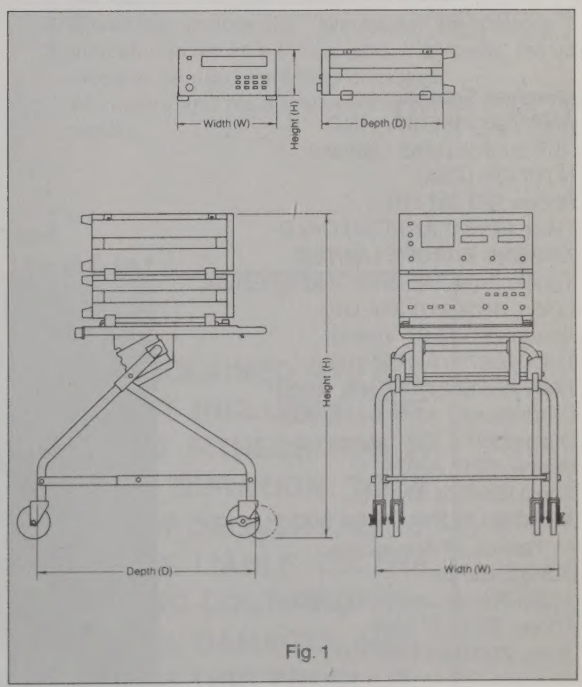

Fig. 1

Outline of Anritsu Corporation

Anritsu Corp. was established in 1931 through the merger of Annaka Denki, which was founded in 1900 and had pioneered developments in radio communication, and Kyoritsu Denki, founded in 1908 and specializing in wire telecommunications. For over half a century since its establishment, Anritsu has developed various types of equipment for application in radio and wire communications. Communications equipment, electronic measuring instruments, industrial equipment, industrial measuring instruments, and data processing equipment have all contributed to its success as an innovator in its field.

Anritsu has persevered in the pursuit of original high-level technology to produce products that respond to the demands of our ever-developing society. An example is the development of its semiconductor laser oscillator in1972, and a laser diameter meter the following year. These advances have contributed greatly to the modernization of optical communication devices. Anritsu recently supplied A.T. & T. with a large quantity of integrated microwave measuring systems, and the company's sturdy public telephones are now in use in countries throughout the world, with its electronic measuring instruments being used in over 130 countries.

Anritsu intends to continue its intense research efforts to contribute to the progress of technology and society alike.

Established.....March 17, 1931
Paid-up capital ¥7,689,000,000
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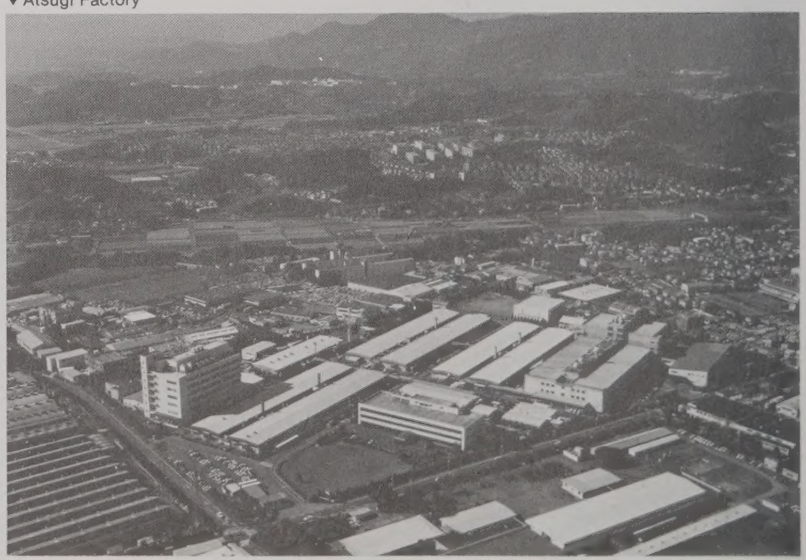
▼Atsugi Factory



Sales, Shipping and Service Information

■ORDER BY MODEL NUMBER

When ordering, please specify the model number and name of instrument desired. For example, "Frequency Synthesizer MG545C." To prevent misunderstandings, include all necessary specifications and specific instructions in your order. That is to say, all special options or features such as special color, nonstandard power line voltage, etc. To expedite your order we suggest that you contact us directly.

■SHIPMENT

Generally, instruments will be shipped within two months of receipt of your order. In the case of "Custom-made products" mentioned in the footnotes, shipment may take from 4 to 7 months. Every endeavor will be made to maintain delivery dates, but no liability is accepted for loss, damage, or delay of instruments, for reasons which are out of our control.

■TERMS

Unless previous terms have been arranged, we will use one of the following:

a. Full payment in advance of shipment
b. Sight draft against an irrevocable confirmed letter of credit

■QUOTATIONS AND PRO-FORMA INVOICES

FOB, CIF, C&F, etc., quotations and proforma invoices are available on request.
The instrument price includes packing charge.

■INSPECTION SURCHARGE

An inspection surcharge is applied to all orders requiring inspection by government agencies or individually appointed inspectors at our factory.

■SPECIAL PRODUCTS MADE-TO-ORDER

Requests for remodeling standard products for special use will be accepted, but only after detailed discussions.

■REPLACING PARTS

To insure you get the right replacement part in the shortest possible time, please indicate:

1. The name, model number and serial number of the instrument for which the part is sought.
2. The name and number of the part as listed in the parts list in the instruction manual.

■RETURNING INSTRUMENT FOR REPAIRS

When returning the instrument to Anritsu for repairs, the following suggestions will help us return it to you in the shortest possible time:

1. Send complete instructions about what you would like done to the instrument.
2. If possible, include the "symptoms" or "defects."
3. Indicate the return address, and, if different, the address to be used for billing purposes.
   All repairs and recalibrations are carried out at our factory.

WARRANTY

ALL OTHER EXPRESS WARRANTIES ARE DISCLAIMED AND ALL IMPLIED WARRANTIES FOR THIS PRODUCT INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED IN DURATION TO A PERIOD OF ONE (1) YEAR FROM THE DATE OF DELIVERY. IN NO EVENT SHALL ANRITSU CORPORATION BE LIABLE TO THE CUSTOMER FOR ANY DAMAGES, INCLUDING LOST PROFITS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THIS PRODUCT.

Quality and Reliability Guarantee System

In pursuit of high reliability

High reliability is the most important and essential factor for measuring instruments. They must perform within the indicated specifications at any time, in any place, and over a long period. If the instruments are unreliable, the results of research and experiments will also be unreliable.

The high reliability of Anritsu products is the result of a comprehensive plan at all the various stages of development, manufacturing, inspection, and service.

The system for guaranteeing high quality and reliability

● In the development stage

The marketing section investigates and analyzes the trends of the market. Through discussion with the sales, engineering, and other related divisions, a basic plan for a new model is made in terms of performance, cost, and reliability.

The engineering department carries out research and experiments according to the basic plan to ensure both safety and reliability. For example, the component parts are carefully selected, and new parts in particular are subjected to internal reliability tests. The selected parts are further checked in the field for problems or faults.

The design specification issued by the engineering department is reviewed by the quality control, manufacturing inspection, and service section. This review is intended to verify development targets in respect to performance, functions, safety, and reliability, and to evaluate their realization. Improvements to the basic plan and design specifications are also adjusted in this review.

A trial model is given thorough evaluation by a project team whose members are selected from the quality control, manufacturing, inspection, and service sections. The project team not only carries out a performance check and environmental tests but also evaluates the "safety," "reliability," "design allowance," "operatability," "manufacturability," and "maintainability" of the model. No model can be put into production until it passes this evaluation.

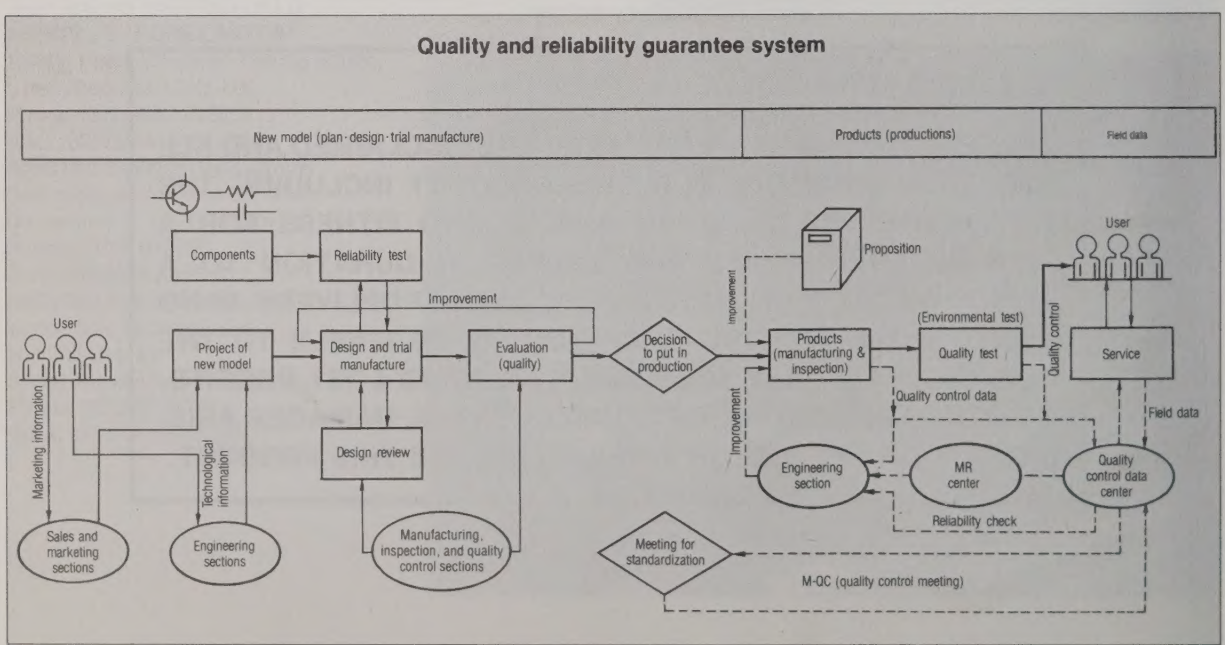
● In manufacturing and inspection stages

The first notable fact in the manufacturing section is that 70% of the employees have passed the national examination of electronic device assembly. The second is that all the manufacturing works are standardized and complete work drawings are fully supplied. The products manufactured by the standardized system and quality-conscious workers are sent to the inspection section to be subjected to the quality tests.

Adjustment and inspection of the model in the inspection section are performed by the experts. Environmental tests and continuous running for over 200 hours to detect initial failure are also performed before the delivery of the products. The ideals of the inspection section are "adjustment-free" and "automated measurement" of the products.

Improvements are always made to the manufacturing and inspection works so as to increase quality. Data obtained in these divisions are sent to the quality control division to be rearranged and analyzed so that the data will be used for a total increase in quality.

Quality and reliability guarantee system

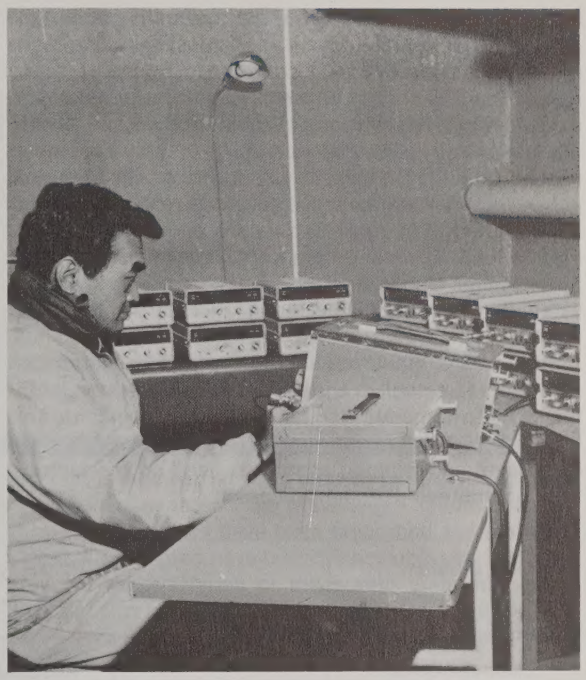


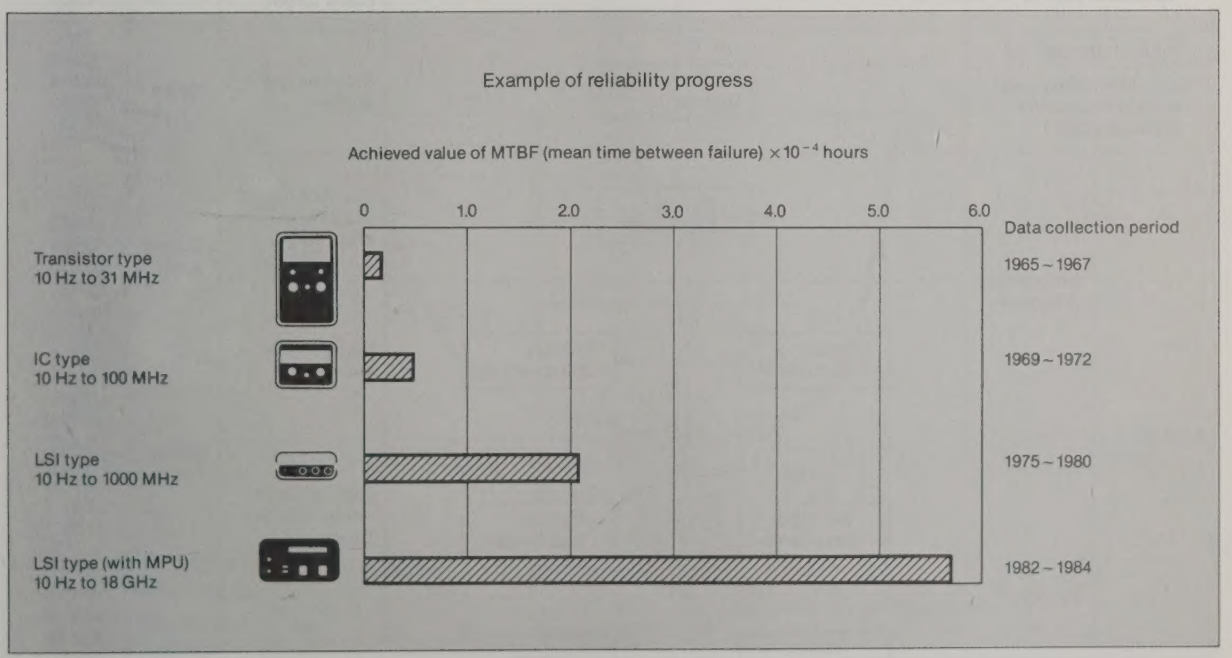
● Field data

All the field data, including that of the product quality sent from users and that obtained from repair and calibration in the service division, are sent to the quality control data center. The quality control section arranges the data according to model and analyzes it, so that the related sections will be well informed of it in order to take necessary action. The MR center (measurement & reliability center), when receiving the field data about reliability from the quality control data center, processes the data by a computer, and compares the designed MTBF and measured MTBF using the processed data to estimate the failure rate of products (cause of failure has been located and necessary action has been taken in this stage). Thus, the MR center supports the engineering section by providing reliability design information to be used for derating and parts selection.

● ZD (zero defect) movement

The above pursuit for high reliability has been supported by ZD activity. Anritsu took the initiative in ZD activity in the measurement and instrumentation field, and started it in 1966. With the 15th anniversary of its inception, Anritsu renewed ZD activity for much higher quality and reliability of products. All our employees keep this in mind and are doing their best in their fields.



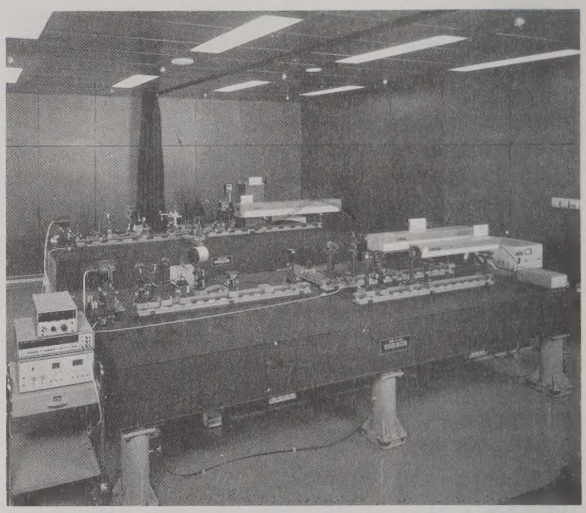


Traceability

Since measuring instruments are the mother tools for all industrial technologies, they must provide high measurement accuracy to conform to domestic standards. The manufacturers need, therefore, to establish a traceability system through field instruments, in-house standards, and national standards.

In the present traceability system for optical power in Japan, national standards are developed and maintained by the Electrotechnical Laboratory of the Ministry of International Trade and Industry's Agency of Industrial Science and Technology. Standards are supplied to private industry through JMI (Japan Machinery and Metals Inspection Institute), a public certification agency.

Anritsu has a standards laboratory and a calibration laboratory to establish and maintain in-house standards traceable to domestic standards. In-house standards are then used to provide regular calibration of measuring equipment and working standards used on the factory floor, guaranteeing product accuracy.



Organization		Hierarchy	Sensor device	Interface	Wavelength (μm)
Government organization Electrotechnical Laboratory (ETL)		National Standards	Calorimeter/ Thermopile, DC Substitution, Au black target	Beam	0.488 0.514 0.633 1.15
Public organization Japan Machinery and Metals Inspection Institute (JMI)		Public Service Standards	Same as the above	Beam	0.488 0.514 0.633 1.15
Anritsu	Standards laboratory	Transfer Standards	Thermopile, DC Substitution, Au black target	Beam/ Fiber	0.488 0.514 0.633 1.15
		Primary Standards (A) ↔ Primary Standards (B)	Same as the above		
	Factory	Working Standards / Factory Instrument	Silicon/Germanium Photo Diode	Beam/ Fiber	0.488 (0.514) 0.633 0.85 1.15 (1.3) (1.5)
		Power Meter (Products) / Others (Products)	—	Fiber	(0.488) (0.514) (0.633) 0.85 (1.15) 1.3 (1.5)

Measuring Instruments for Optical Communications

By using glass instead of metal as the transmission medium, optical fiber communications secure the following advantages: low loss, wide bandwidth, non-inductive transmissions without crosstalk, highly insulated, thin, and lightweight cables. Accordingly, a tenfold increase in both the distance between relay stations and the information content has become possible. In recent years, efforts around the world have exploited these advantages for technical and commercial development of both long-distance transmission without relays and high-volume communication.

Anritsu has realized the potentiality of optical communications at early stage and has commenced research on semiconductor lasers. In 1972 we successfully modulated a semiconductor pulsed laser oscillator at high speeds. Applying this technology, Anritsu successfully completed pilot production of six-channel optical telephones and tested free-space transmission over spans of 2 km.

In the following years, Anritsu became a domestic and international supplier of high-speed pulsed semiconductor laser oscillators for research purposes. In response to the rapidly expanding needs for instruments for testing and measuring optical communication systems, we have concentrated our efforts on developing integrated instruments and meters for optical communications such as optical power meters, optical time-domain reflectometers, and optical spectrum analyzers.

Optical fiber communications and wavelength

The wavelengths employed in optical fiber communications are selected to match the regions where the optical losses of the fibers are low, and fall in the near-infrared (0.76 μm to 1.2 μm) and infrared (above 1.3 μm) regions. Figure 1 shows the characteristics of one fiber relative to wavelength. In recent years, fibers have been manufactured in which the absorption due to OH radicals in the vicinity of 1.4 μm (shown by the dotted line) has been eliminated. The wavelength characteristics shown in the Figure have been smoothed and shifts to longer wavelengths have become possible. Anritsu now provides various types of measuring instruments for long and short wavelengths, and is continuing efforts to expand the items such as 1.55 μm band light source.

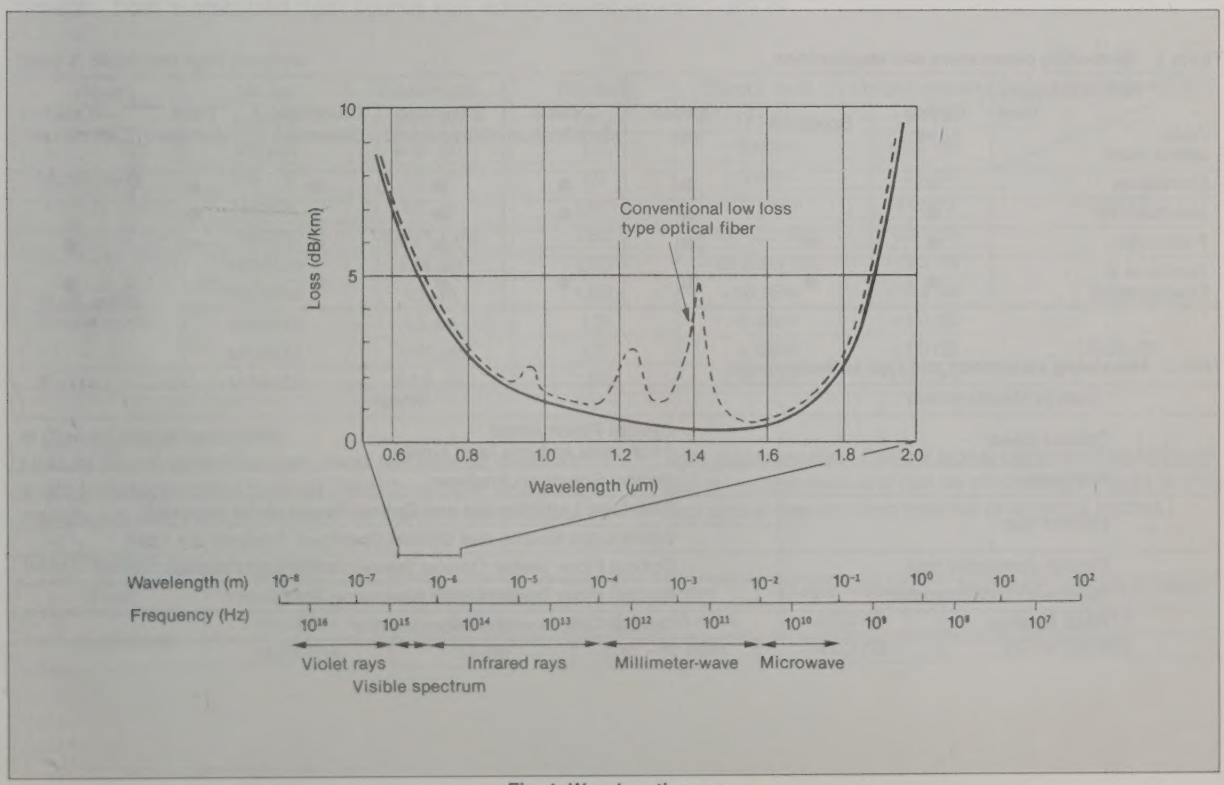


Fig. 1 Wavelength range

Measurement systems for optical fiber communications

The basic structure of a communications system using optical fibers is shown in Figure 2. Instruments for measuring optical fiber communications are primarily used between the E/O and O/E converters. Table 1 lists the parameters which are measured in these systems grouped according to their applications. Table 2 is a classification of the measurement parameters and their corresponding measuring instruments. The development of measuring instruments for the 0.85 μm and the 1.3 μm bands has already been completed for both single-mode and multi-mode transmission systems. Development of instruments for the 1.55 μm band has been continuing.

Table 3 lists representative instruments made by Anritsu for single-mode fibers.

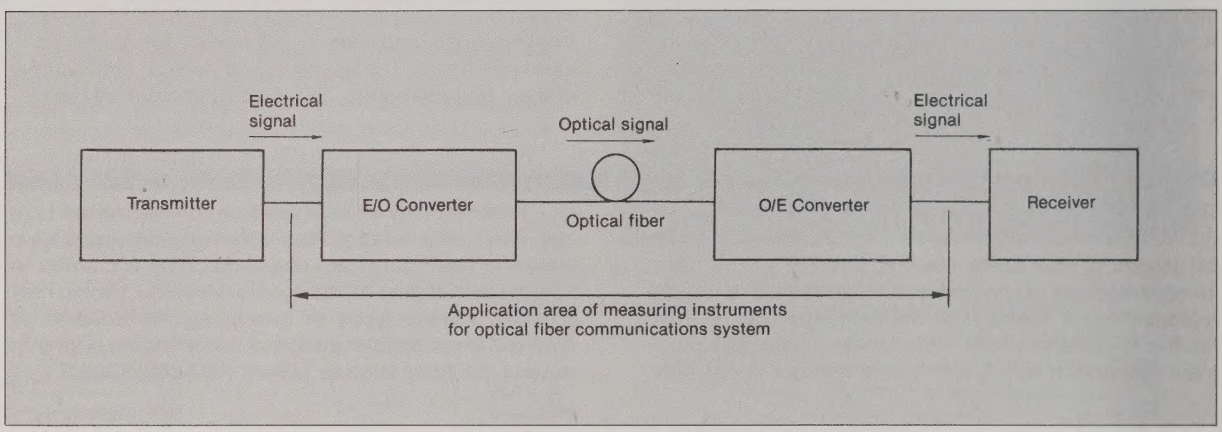


Fig. 2 System composition

Table 1 Measuring parameters and applications

Item of Measurement / Application fields	Optical power	Spectrum	Optical loss	Optical identification	Baseband characteristic	Chromatic dispersion	Fault location	Laser diode test
Installation	●		●	●	●	●	●	
Maintenance	●		●	●	●		●	
Production	●	●	●		●	●	●	●
Research & Development	●	●	●	●	●	●		●

Table 2 Measuring parameters and type of instruments

Item of Measurement	Model
Optical power	Optical Power Meter (High level and low level type)
Spectrum	Optical Spectrum Analyzer
Optical loss	Stabilized Light Source and Optical Power Meter are used.
	White Light Source and Optical Spectrum Analyzer are used.
Optical continuity test	Optical Fiber Tester, Optical Tester, Visible Light Source
Baseband characteristic	Optical Fiber Transmission Measuring Equipment
Fault location	Optical Time Domain Reflectometer

Table 3 Measuring instruments for single-mode fiber

Measuring instruments	Model
Optical Power Meter	ML93B-MA96E MA98A MA913E ML94A-MA98A MA913E ML910A-MA9301A MA9302A MA9305A ML96B-MA98A MA913E MA917A
Stabilized Light Source	MG921A (LD 1.3 μm) MG923A (LD 1.55 μm) MG96A (LED 1.3 μm) MG925A (LED 1.3 μm) MG932A (LED 1.55 μm)
Optical Time Domain Reflectometer	MW98A, MH925B, MH929B MW910A, MH938A/A1, MH939A/A1, MH955A/A1 MW920A, MH958A
Visible Light Source	MG99B
Optical Fiber Tester	MS97A
Chromatic Dispersion Measuring Set	ME9301A

● Stabilized light sources

Three types of light sources are used in optical communications systems: (1) stabilized light sources, (2) stabilized light sources that can be modulated by a baseband signal, and (3) visible light sources which can be seen by the naked eye. When measuring losses in optical fibers, splicing losses, or insertion losses in optical components, both a stabilized light source and an optical power meter are indispensable.

Either laser diodes or LEDs are used in stabilized light sources. In the case of laser diodes, the output is stabilized using a negative feedback loop; for LEDs, a temperature compensation scheme is used to stabilize the output. Table 4 is a summary of Anritsu's stabilized light sources.

Table 4 Stabilized light sources

Fiber	Model	Wavelength	Element	Output level	Output stability	Short-term stability
Multi-mode	MG93B	0.85 μm	LED	−13 dBm	<0.1 dB	<0.02 dB
	MG94B	0.85 μm	LD	−3 dBm	<0.2 dB	
	MG97B	1.3 μm	LD	−3 dBm	<0.2 dB	
	MG96A	1.3 μm	LED	−20 dBm	<0.1dB	
	MGV5	0.85/1.3 μm	LED	−13/−20 dBm	<0.1 dB	
Multi-mode Single-mode	MG932A	1.55 μm	LED	−23 dBM (GI)	<0.1 dB	
	MG925A	1.3 μm	LED	−50 dBm	<0.2 dB	
	MG921A	1.3 μm	LD	−6 dBm	<1.0 dB	<0.05 dB
	MG923A	1.55 μm	LD	−6 dBm	<1.0 dB	
Plastic	MG927A	0.66 μm	LED	−10 dBm	<0.4 dB	

● Optical signal generator

Optical signal generators are used not only to measure analog characteristics such as linearity of light receiving devices but also used to measure the lowest level of digital light signal receiver. Optical signal generators provide output of variable level and can be modulated by both analog and digital signals from internal or external source.

Table 5 Optical signal generators

Fiber	Model	Wavelength	Output level	Output stability	Modulation frequency range
Multi-mode	MG9801A	0.85 μm	+5 to −55 dBm	<0.2 dB	DC to 150 MHz
	MG9301A	1.3 μm	0 to −60 dBm	<0.2 dB	DC to 150 MHz

● **Measurement of optical power**

Measurement of optical power is the prime of optical measurements. Anritsu's power meters contain both an optical power sensor and an indicator. The optical power sensor performs optoelectric conversion (O/E conversion) of light propagating through optical fibers or free space from a laser diode or LED source. The indicator displays the power of the electric signal converted from the incoming light. Several interchangeable optical power sensors can be employed to match the waveband being measured. When measuring low power levels, optical power sensors incorporating tuning fork choppers are used.

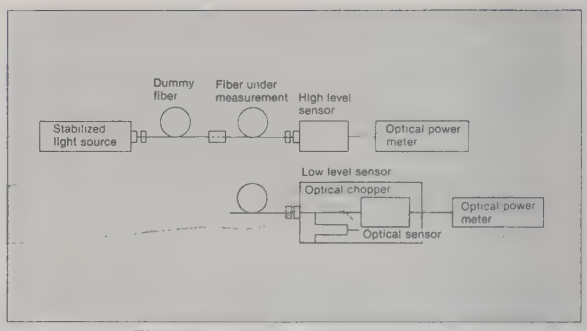


Fig. 3 Measurement of optical loss

Table 6 Optical power measurement range

Indicators	Sensors	Wavelength range (μm)	Power measuring range (dBm)
			−90 −80 −70 −60 −50 −40 −30 −20 −10 0 +10 +20
ML93B	MA95A	0.38 to 1.15	
	MA97B		
	MA911A	0.4 to 1.15	
	MA912A		
	MA96E	0.75 to 1.7	
	MA98A	0.75 to 1.8	
	MA913E	0.75 to 1.7	
ML94A, ML96B	MA97B	0.38 to 1.15	
	MA911A	0.4 to 1.15	
	MA912A		
	MA98A	0.75 to 1.8	
	MA913E	0.75 to 1.7	
ML96B	MA916A	0.4 to 1.15	
	MA917E	0.75 to 1.7	
ML910A	MA9801A	0.38 to 1.15	
	MA9301A	0.75 to 1.7	
	MA9802A	0.38 to 1.15	
	MA9302A	0.75 to 1.8	
	MA9305A	0.75 to 1.7	

● Measurement of optical losses

Two main techniques are used to measure optical losses: the two-point technique and the backscattering technique. In the two-point technique, the optical losses are measured by comparing the input optical power and the output power from the fiber being measured. Since the measurement error in this technique is limited only by the stability of the light source and the power meter, extremely accurate measurements can be made. In the backscattering technique, a time domain reflectometer is used to measure the losses by collecting the light which is backscattered from the fiber, permitting measurements to be made from only one end. The range of optical losses which can be measured using both an optical power meter and a stabilized light source is detailed for multi-mode fibers in Table 7 and for single-mode fibers in Table 8.

Table 7 Optical loss measurement range using optical power meters and stabilized light sources (for multi-mode fibers).

Power meters \ Stabilized light sources		MG93B (0.85 μm)	MG96A (1.3 μm)	MG932A (1.55 μm)	MG94B (0.85 μm)	MG97B (1.3 μm)	MG927A (0.66 μm)
		LED			LD		LED
ML910A (Indicator)	MA9801A Sensor	77 dB	—	—	87 dB	—	80 dB
	MA9301A Sensor	—	70 dB	67 dB	—	87 dB	—
	MA9802A Sensor	52 dB	—	—	62 dB	—	55 dB
	MA9302A Sensor	—	20 dB	17 dB	—	37 dB	—
	MA9305A Sensor	—	40 dB	37 dB	—	57 dB	—
ML93B (Indicator)	MA95A Sensor	77 dB	—	—	87 dB	—	80 dB
	MA96E Sensor	—	70 dB	67 dB	—	87 dB	—
	MA97B Sensor	52 dB	—	—	62 dB	—	55 dB
	MA98A Sensor	—	20 dB	17 dB	—	37 dB	—
	MA911A Sensor	47 dB	—	—	57 dB	—	50 dB
	MA912A/B Sensor	47 dB	—	—	57 dB	—	50 dB
	MA913E Sensor	—	40 dB	37 dB	—	57 dB	—
ML94A ML96B (Indicators)	MA97B Sensor	47 dB	—	—	57 dB	—	50 dB
	MA98A Sensor	—	20 dB	17 dB	—	37 dB	—
	MA911A Sensor	47 dB	—	—	57 dB	—	50 dB
	MA912A Sonsor	47 dB	—	—	57 dB	—	50 dB
	MA913E Sensor	—	40 dB	37 dB	—	57 dB	—
ML96B (Indicator)	MA916A Sensor	47 dB	—	—	57 dB	—	50 dB
	MA917E Sensor	—	40 dB	37 dB	—	57 dB	—

Table 8 Optical loss measurement range using optical power meters and stabilized light sources (for single-mode fibers).

Power meters \ Stabilized light sources		MG925A (1.3 μm)	MG96A (1.3 μm)	MG932A (1.55 μm)	MG921A (1.3 μm)	MG923 (1.55 μm)
		LED			LD	
ML910A (Indicator)	MA9301A Sensor	40 dB	52 dB	47 dB	84 dB	84 dB
	MA9302A Sensor	—	—	—	34 dB	34 dB
	MA9305A Sensor	10 dB	22 dB	17 dB	54 dB	54 dB
ML93B (Indicator)	MA96E Sensor	40 dB	52 dB	47 dB	84 dB	84 dB
	MA98A Sensor	—	2 dB	—	34 dB	34 dB
	MA913E Sensor	10 dB	22 dB	17 dB	54 dB	54 dB
ML94A, ML96B (Indicators)	MA98A Sensor	—	—	—	34 dB	34 dB
	MA913E Sensor	10 dB	22 dB	17 dB	54 dB	54 dB
ML96B (Indicator)	MA917E Sensor	10 dB	22 dB	17 dB	54 dB	54 dB

● Measurement of baseband frequency characteristics

A pulse technique and a frequency sweep technique are used to measure the baseband frequency characteristics of optical fibers. Anritsu has adopted the frequency sweep technique because measurements are highly accurate and easy to perform. As Figure 4 shows, there are two approaches to this technique: the end-to-end and the loop-back approaches. In the end-to-end approach, the output of the frequency synthesizer producing the baseband signal (a sinusoidal electric signal) is changed by an E/O converter into an intensity modulated optical signal. After passing through the optical fiber, the original baseband signal is recovered by an O/E converter. The level of this signal is measured by a selective level meter.

In the loop-back approach, a tracking generator is used together with a spectrum analyzer. Since measurements can be made over a frequency range from 100kHz to 1GHz, this technique is used during the manufacture of optical fibers to evaluate their characteristics.

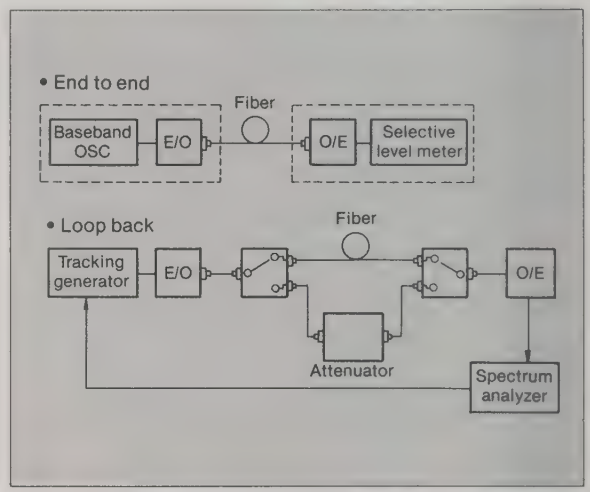


Fig. 4 Measurement composition of baseband frequency characteristic

Table 9 Optical fiber transmission measuring sets

Model	Wavelength (μm)	Measuring method	Applications		Remarks
ME96A	0.85 1.30	Point-by-point frequency	End-to-end and loop measurement	R & D, Installation, Maintenance	1 MHz and 10 to 800 MHz (in 10 MHz steps)
ME96B	0.85				
ME96C	1.30				
ME98A	0.85	Continuous swept frequency	Loop measurement	R & D, Production	100 kHz to 1000 MHz
ME98B	1.30				
ME98C	0.85 1.30				
ME98D	0.85				100kHz to 50MHz
ME98E	1.30				
ME98F	0.85 1.30				

● Chromatic dispersion characteristics measurement

Chromatic dispersion characteristics measuring methods for single-mode fiber are largely classified into two categories. The one is pulse delay time difference measurement method and the other is phase comparison method. Anritsu adopts the baseband phase comparison method and uses multiple laser diodes to design an equipment that have a wide dynamic range in a compact body.

The Anritsu ME9301A is also light in weight, and has ability for end-to-end measurement. Therefore, characteristics of installed optical fiber line can be measured easily.

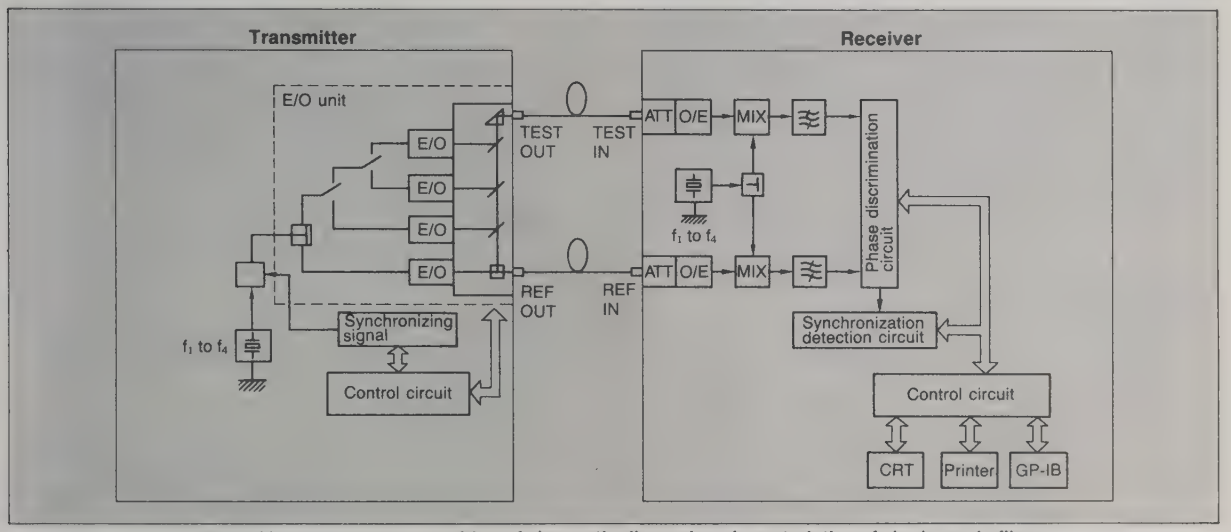


Fig. 5 Measurement composition of chromatic dispersion characteristics of single mode fiber

Model	Wave length	Measuring method	Applications	
ME9301A	1.25 to 1.55 μm	Baseband phase comparison method	Loop back and end-to-end	R & D Production Confirmation of installed line performance
	1.50 to 1.60 μm			

● Locating faults in optical fibers

Instruments for locating faults that occur in optical fiber cables are indispensable for optical communication systems. Since a reflected pulse is always produced by a fault in conventional copper cables, such faults can be located by observing the reflected pulse. In optical fibers, however, there are many cases (depending upon the nature of the damage) in which a reflected pulse is not produced.

However, since there are micro-variations smaller than the light's wavelength in the optical fiber cable, a type of scattered light, called Rayleigh scattering, arises. A portion of this scattered light is oriented along the axis of the fiber, enters the fiber's waveguide mode, and returns to the end of the fiber where the pulse was injected. By measuring the level of this weak, reflected light ("backscattering"), the fault can be located. The level of the backscattering depends upon the propagation time, and drops off exponentially. The optical losses per unit length in the fiber can be found from variations in the level of the backscattering; faults can be located because they eliminate further backscattering.

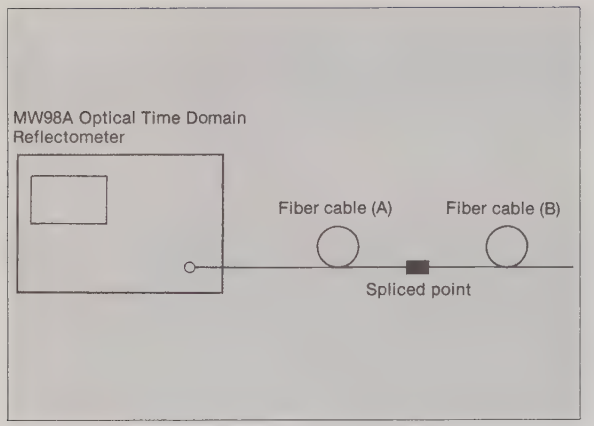


Fig. 6 Measurement of splice loss

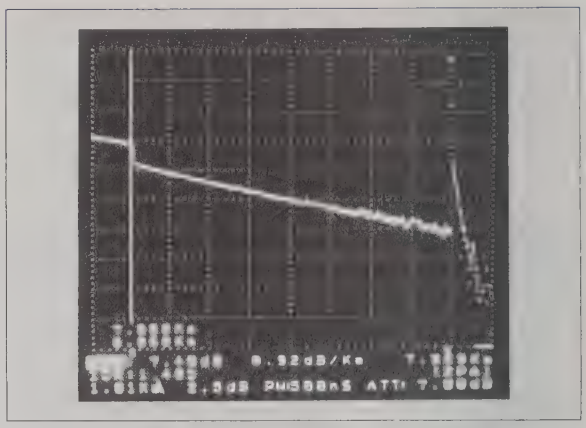


Photo 1 Example of backscattering measurement using the Optical Time Domain Reflectometer

Table 10 List of permissible combinations

Model	Unit	Wavelength	Applicable fiber	Dynamic range	Applications
MW98A	MH913B	0.85 μm	Multi-mode	22.5 dB	Production, installation, maintenance and development for fiber cable (for long distance)
	MH914C	1.3 μm	Multi-mode	20 dB	
	MH925B	1.3 μm	Single-mode	16 dB	
	MH929B	1.55 μm	Single-mode	14 dB	
MW910A	MH963A/A1	0.85 μm	Multi-mode	23 dB	
	MH937A/A1	1.31 μm	Multi-mode	22 dB	
	MH938A/A1	1.31 μm	Single-mode	20 dB	
	MH939A/A1	1.55 μm	Single-mode	18 dB	
	MH955A/A1	1.31/1.55 μm	Single-mode	18/16 dB	
MW920A	MH951A	0.85 μm	Multi-mode	18 dB	(for short distance)
	MH952A	1.30 μm	Multi-mode	14 dB	
	MH958A	1.30 μm	Single-mode	10 dB	

● Testing the continuity of optical fiber cables

Continuity can be confirmed by the naked eye or checked by simple loss measurements. When using the eye, a visible light source is connected to the input end of the fiber as shown in Figure 7, and continuity is judged according to the light scattered from the output end of the fiber. When checking continuity by measuring losses, an optical tester (Figure 8) or an optical fiber tester (Figure 9) is used. Since optical testers consist of a light source and an optical reception unit in a single package, in the case of loop-back measurements, one device can be used, while two devices are used in the case of end-to-end measurements.

Since the transmission and reception units of optical fiber tester are separated, they have the advantage of allowing continuity tests to be performed without cutting the fiber.

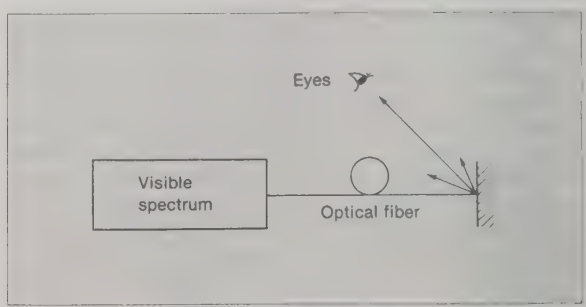


Fig. 7 Visual inspection

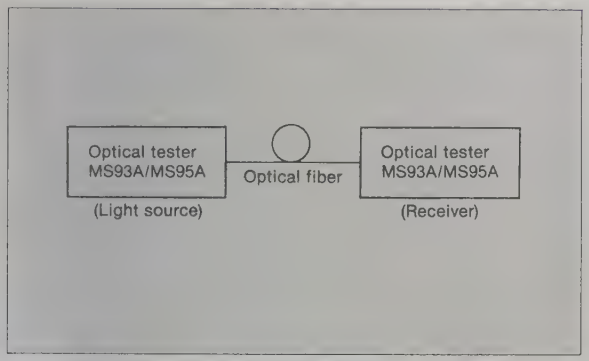


Fig. 8 Measurement composition of optical tester

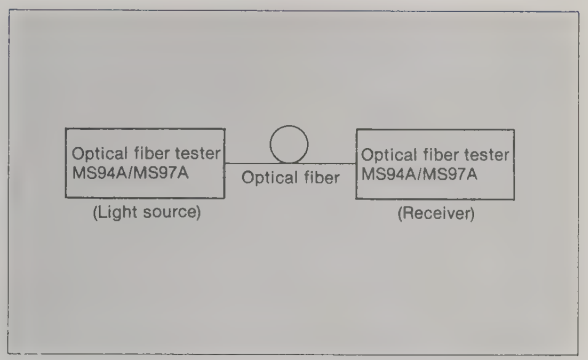


Fig. 9 Measurement composition of optical fiber tester

Tabel 10 Allowable loss of optical fiber for identification test and voice communication

Model	Input type	Coupling loss (dB)	Allowable loss of optical fiber (dB)		Light source
			Identification test	Voice communication	
MS93A Optical Tester	Connector coupling	0	35	25	LED 0.85 μm 1.3 μm
MS95A Optical Tester	Connector coupling	0	35	25	LED 0.85 μm
MS94A Optical Fiber Tester	Connector coupling	0	70	—	LED 0.85 μm
	Optical leak sensor	20 to 50	20 to 50	—	
	Optical break sensor	15 to 25	45 to 55	—	
MS97A Optical Fiber Tester	Connector coupling	0	68	—	LD 1.3 μm
	Optical leak sensor	20 to 50	18 to 48	—	
	Optical break sensor	15 to 25	43 to 53	—	
MG99B Visible Light Source	Visual inspection	—	40	—	Gas laser 0.63 μm

● Optical portable telephone

Communication and testing are required at the time of installation and maintenance of optical fiber cables.

The MS98A was developed for this purpose.

Model	Applicable fiber	Wavelength	Allowable loss for communication possibility
MS98A	GI, SM	1.3 μm	0 to 37 dB (SM), 0 to 27 dB (GI)

● Wavelength and spectrum measurements

Optical spectrum analyzers are bocoming indispensable in optical communications. Phenomena which can be measured by spectrum analyzers are the central emission wavelength of laser diodes and LEDs, the spectral half-width, and loss-wavelength characteristics in optical fibers, optical filters, and other optical components.

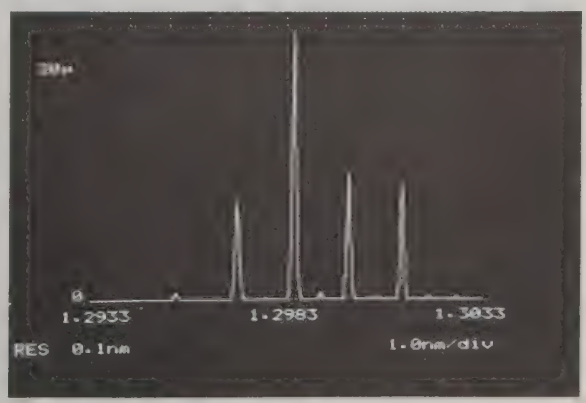


Photo 2 Laser diode spectrum

Table 12 Measurement range of optical spectrum analyzer

Model	Wavelength range	Level measuring range	Wavelength accuracy	Resolution	Level accuracy
MS99A	0.35 to 1.1 μm	−60 to 0 dBm (0.45 to 1.0 μm) −55 to 0 dBm (0.55 to 1.1 μm) at 0.5 to 5 nm resolution	±1 nm	0.1 to 5 nm	—
MS9001A	0.6 to 1.75 μm	−70 to +10 dBm (0.7 to 1.6 μm) −65 to +10 dBm (0.6 to 0.7 μm) −55 to +10 dBm (1.6 to 1.75 μm) [dynamic range: >45 dB]	±1 nm ±0.5 nm (at 25°C)	0.1 to 5 nm	±2 dB (0.85 μm 1.3 μm 1.55 μm)
MS9001A1	0.6 to 1.75 μm	−70 to +10 dBm (0.7 to 1.6μm) −65 to +10 dBm (0.6 to 0.7 μm) −55 to +10 dBm (1.6 to 1.75 μm) [dynamic range: >50 dB]	±1 nm ±0.5 nm (at 25°C)	0.1 to 5 nm	±2 dB (0.85 μm 1.3 μm 1.55 μm)
MS9003A/B	1.2 to 1.6 μm	−55 to 0 dBm −30 to 0 dBm at 2.7 nm (MS9003B) and 13 pm (MS9003A/B) BW	±1 nm	13 pm (MS9003A) 2.7 pm (MS9003B)	—

● Wavelength measurement

Measurement of optical wavelengths is one of the most important measurement items in optical fiber communications systems. By simply receiving output signals from the light source with optical fiber, Anritsu's Optical Wavelength Meters allow digital display of optical wavelengths and light power.

The input light received by our wavelength meter is optically rotated by an internal optical rotator. The center wavelength of the light is obtained by processing the optical rotary power numerically.

Table 13 Measurement range of wavelength

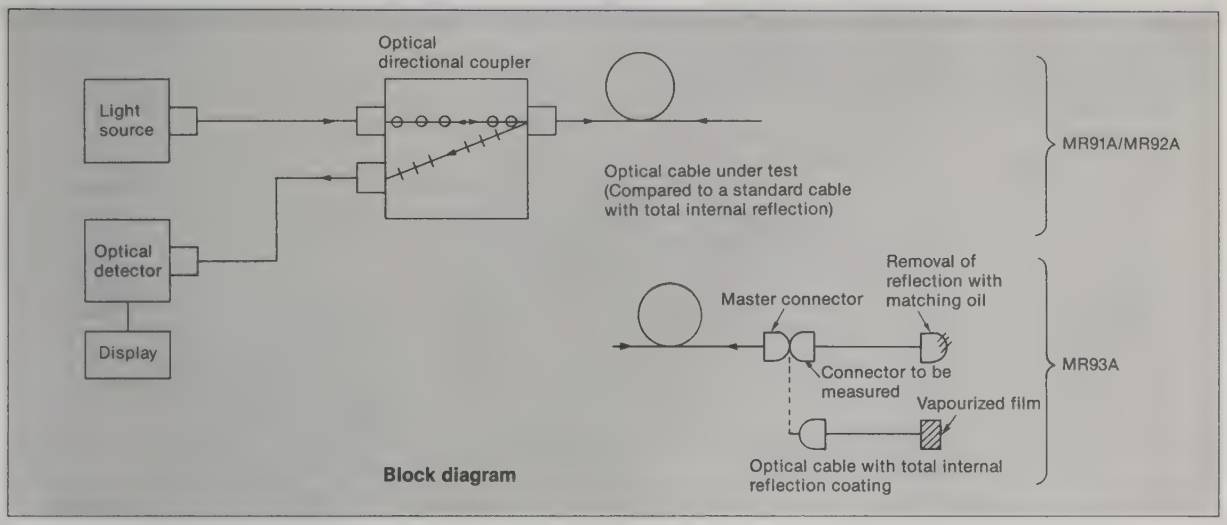
Model	Unit	Wavelength range	Level range	Wavelength accuracy
MF91A	MH930A	0.4 to 0.8μm	−55 to +10dBm	Within ±0.5% When spectral half width is less than 10nm
	MH931A	0.6 to 1.0μm	−60 to +10dBm	
	MH932A	1.0 to 1.6μm	−55 to +5dBm	

● Optical return loss measurement

The Anritsu Optical Return Loss Measuring Set is conformable to the multi-mode optical fibers (Graded Index 50/125 μm; Numerical Aperture 0.2). It measures the reflection factor (return loss) of the slant-cut surface of an optical connector. Using the fiber with an optical connector, it evaluated the reflection factor of optical devices. The MR93A can measure SM connectors (NTT specification, PC type) with small reflection loss.

Table 14 List permissible combinations

Model	Light source unit	Applicable fiber	Wavelength	Measurement range	Measurement stability
MR91A	MH918A	GI	0.81 μm	0 to 40 dB	Within 1 dB
	MH919A		0.89 μm		
	MH927A		0.85 μm		
MR92A	MH920A		1.3 μm		
	MH926A		1.2 μm		
MR93A	——	SM	1.31 μm	0 to 35 dB	



Block diagram

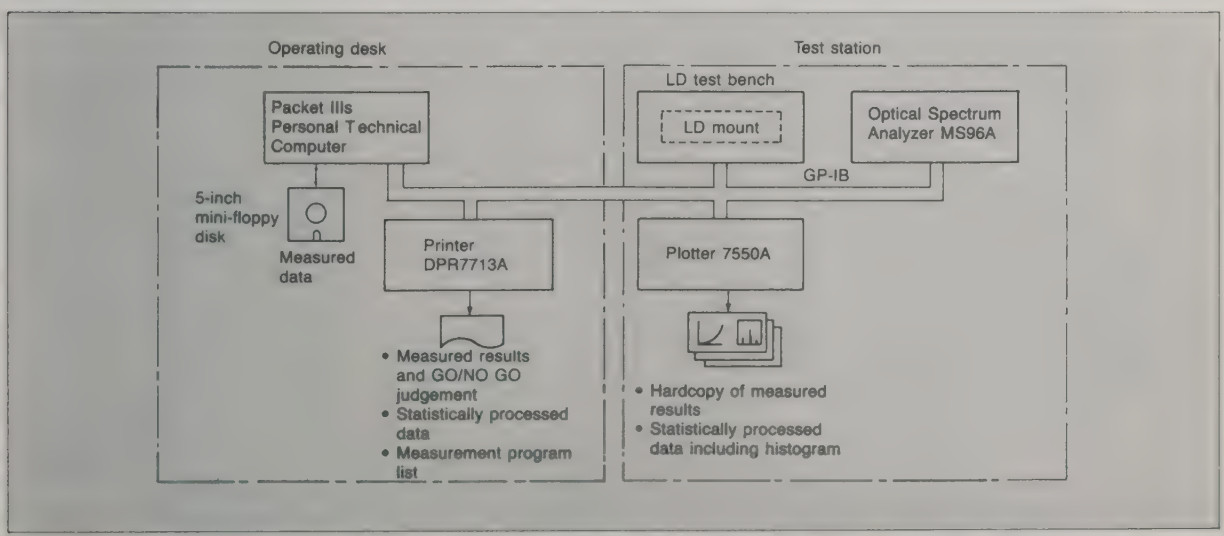
● Laser diode measurement

Numbers of test items are required on laser diodes used as light sources for optical communication systems. These items are tested using a lot of discrete instruments up to this time. Now Anritsu offers an automatic LD test system. Once the LD is simply placed on a test mount, the test system does the rest. Measured results are put out to a plotter.

Measuring items

- Current vs. Optical power I-L
- Current vs. Forward voltage I-V
- Current vs. Monitor current I-Im
- PD dark current Imd
- Spectrum pattern
- Far-field pattern (FFP)

Model	Wavelength range	Driving current range	Optical power measuring range	Far-field pattern
ME9002A	0.6 to 1.6 μm	0 to 500 mA (CW)	0 to 100 mW	±60°

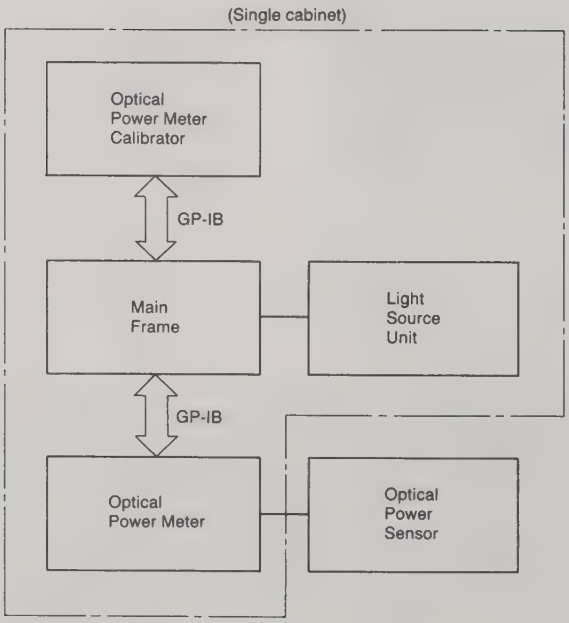


ME9001A Automatic LD Test System block diagram

Optical Power Meter Calibration

The Anritsu Optical Power Meter Calibration Systems can be used as working standards for the purpose of absolute power level calibration at fixed two wavelengths.

Model	Light Source Unit	Optical Power Meter	Optical Power Sensor	Optical Power Meter Calibrator	Remarks
MT9501A	MT0901A	ML910A1	MA9308A	MG3001B	0.85 μm
	MT0902A		MA9501A		1.3 μm
MT9501B	MT0901A	ML910A1	MA9308A	MG3001B	0.85 μm
MT9501C	MT0902A	ML910A1	MA9501A	MG3001B	1.3 μm



● Measuring instruments for optical fiber communications

Model \ Application	Optical power: Low level	Optical power: Medium/high level	Optical power meter calibration	Light source wavelength: Spectrum	Light source wavelength: Wavelength	Loss: High-loss	Loss: High accuracy	Loss: Loss-wavelength	Optical identification: Identification	Optical identification: Loss	Optical return loss measurement	Baseband characteristic: End to end	Baseband characteristic: Loop back	Baseband characteristic: O/E Conv. and waveform	Fiber evaluation: E/O Conv.	Fiber evaluation: Fault location	Splice loss	Etc.	Remarks	Page
Light source	MG94B Stabilized light source					●											●		0.85μm LD	31
	MG97B Stabilized light source					●											●		1.3μm LD	
	MG9801A Optical signal generator					●													0.85μm LD	33
	MG9301A Optical signal generator					●													1.3μm LD	
	MG921A Stabilized light source					●	●										●		1.3μm LD	37
	MG923A Stabilized light source					●	●										●		1.55μm LD	
	MG93B Stabilized light source						●										●		0.85μm LED	39
	MG96A Stabilized light source						●										●		1.3μm LED	
	MG932A Stabilized light source						●										●		1.55μm LED	
	MGV5 Stabilized light source						●										●		0.85/1.3μm LED	41
	MG925A Stabilized light source						●										●		1.3μm LED	43
	MG927A Stabilized light source					●	●												0.66μm LED	45
	MG922A White light source				●			●											0.6 to 1.6μm Halogen lamp	47
	MG99B Visible light source								●										0.63μm He-Ne Laser	48
Optical power meter	ML93B Optical power meter	●	●				●	●											−90 to +10dBm (Short wavelength) −90 to +10dBm (Long wavelength)	52
	ML94A Optical power meter		●					●											−60 to +10dBm (Short wavelength)	59
	ML96B Optical handy power meter		●					●											−60 to +10dBm (Long wavelength)	
	MA95A Optical sensor	●					●	●											0.38 to 1.15μm, −90 to 0dBm	54 / 59
	MA96E Optical sensor	●					●	●											0.75 to 1.7μm, −90 to 0dBm	
	MA97B Optical sensor		●					●											0.38 to 1.15μm, −65 to +10dBm	
	MA98A Optical sensor		●					●											0.75 to 1.8μm, −40 to +10dBm	
	MA911A Optical sensor		●					●											0.4 to 1.15μm, −60 to +10dBm	
	MA912A/B Optical sensor		●					●												
	MA913E Optical sensor		●					●											0.75 to 1.7μm, −60 to 0dBm	
	MA916A Optical sensor		●					●											0.4 to 1.15μm, −60 to +10dBm	
	MA917E Optical sensor		●					●											0.8 to 1.8μm, −60 to 0dBm	
	MZ130A Sensor array		●					●									●		0.38 to 1.15μm, −65 to +10dBm	57
	MZ147B Sensor array		●					●									●		0.75 to 1.7μm, −50 to 0dBm	
	MZ129A Channel selector																	●	GP-IB	58
	ML910A Optical power meter	●	●				●	●												64
	MA9801A Optical sensor	●					●	●											0.38 to 1.15μm, −90 to 0dBm	
	MA9301A Optical sensor	●					●	●											0.75 to 1.7μm, −90 to 0dBm	
	MA9802A Optical sensor		●					●											0.38 to 1.15μm, −65 to +20dBm	
	MA9302A Optical sensor		●					●											0.75 to 1.8μm, −40 to +20dBm	
	MA9803A Optical sensor		●					●											0.38 to 1.15μm, −65 to +10dBm	
	MA9303A Optical sensor		●					●											0.75 to 1.8μm, −40 to +10dBm	
	MA9804A Optical sensor		●					●											0.38 to 1.15μm, −65 to +10dBm	
	MA9304A Optical sensor		●					●											0.75 to 1.8μm, −40 to +10dBm	
	MA9305A Optical sensor		●					●											0.75 to 1.7μm, −60 to 0dBm	
Optical power meter calibration	MT9501A Optical power meter calibration system			●															at 0.85μm/1.3μm	73
Optical wavelength meter	MF91A Optical wavelength meter		●			●	●													79
	MH930A Plug-in unit		●			●	●												0.4 to 0.8μm, −55 to +10dBm	
	MH931A Plug-in unit		●			●	●												0.6 to 1.0μm, −60 to +10dBm	
	MH932A Plug-in unit		●			●	●												1.0 to 1.6μm, −50 to 0dBm	

Model	Application	Optical power: Low level	Optical power: Medium/high level	Optical power meter calibration	Light source wavelength: Spectrum	Light source wavelength: Wavelength	Loss: High-loss	Loss: High accuracy	Loss: Loss-wavelength	Optical identification: Identification	Optical identification: Loss	Optical return loss measurement	Baseband characteristic: End to end	Baseband characteristic: Loop back	Baseband characteristic: E/O Conv.	Baseband characteristic: O/E Conv. and waveform	Fiber evaluation: Fault location	Fiber evaluation: Splice loss	Laser diode testing	Etc.	Remarks	Page
Optical fiber tester	MS94A/MS97A Optical fiber tester									●	●										0.85μm (MS94A) 1.3μm (MS97A)	82
Optical tester	MS93A/MS95A Optical tester									●	●										0.85μm, 1.3μm (MS93A) 0.85μm (MS95A)	87
Optical telephone	MS98A Optical portable telephone																			●		91
Optical return loss measuring sets	MR91A Optical return loss measuring set (Main frame)											●										96
	MH918A Light source unit											●									0.81μm	97
	MH919A Light source unit											●									0.89μm	
	MH927A Light source unit											●									0.85μm	
	MR92A Optical return loss measuring set (Main frame)											●										96
	MH920A Light source unit											●									1.3μm	97
	MH926A Light source unit											●									1.2μm	
	MR93A Optical return loss measuring set											●									1.31μm SM	99
Optical spectrum analyzer	MS99A Spectrum Analyzer				●	●															0.35 to 1.1μm	101
	MS9003A/B Spectrum Analyzer				●	●															1.2 to 1.6 μm	117
	MS9001A/A1 Spectrum Analyzer				●	●															0.6 to 1.75μm	108
Optical time domain reflectometer	MW98A Optical time domain reflectometer (Main frame)																●	●			1m readout resolution 72km range	121
	MH913B Plug-in unit																●	●			0.85μm, Multi-mode fiber	
	MH914C Plug-in unit																●	●			1.3μm, Multi-mode fiber	
	MH925B Plug-in unit																●	●			1.3μm, Single-mode fiber	
	MH929B Plug-in unit																●	●			1.55μm, Single-mode fiber	
	MW910A Optical time domain reflectometer (Main frame)																●	●			1m readout resolution 144km range	130
	MH963A/A1 Plug-in unit																●	●			0.85μm Multi-mode fiber	
	MH937A/A1 Plug-in unit																●	●			1.31μm, Multi-mode fiber	
	MH938A/A1 Plug-in unit																●	●			1.31μm, Single-mode fiber	
	MH939A/A1 Plug-in unit																●	●			1.55μm, Single-mode fiber	
	MH955A/A1 Plug-in unit																●	●			1.31/1.55μm, Single-mode fiber	
	MW920A Optical time domain reflectometer (Main frame)																●	●			10cm readout resolution 15km/40km range	140
	MH951A Plug-in unit																●	●			0.85μm, Multi-mode fiber	
	MH952A Plug-in unit																●	●			1.3μm, Multi-mode fiber	
	MH958A Plug-in unit																●	●			1.3μm Single-mode fiber	
E/O Converter	MG92A/B, MG912B Unit															●					0.85μm LD (MG92A/B) 1.3μm LD (MG912B)	150
	MG910A, MG911A Unit															●					0.85μm LED (MG910A) 1.3μm LED (MG911A)	
	MZ100A E/O Converter (Main frame)															●						
	MH945A E/O Converter unit															●					1.31μm	234
O/E Converter	MZ118A O/E Converter (Main frame)														●							153
	MH922A Plug-in unit														●						0.85μm	
	MH923A Plug-in unit														●						1.3μm	
	MH946A O/E Converter unit														●						1.31μm	234

Continued on next page.

Model \ Application		Optical power: Low level	Optical power: Medium/high level	Optical power meter calibration	Light source wavelength: Spectrum	Light source wavelength: Wavelength	Loss: High-loss	Loss: High accuracy	Optical identification: Identification	Optical identification: Loss	Optical return loss measurement	Baseband characteristic: End to end	Baseband characteristic: Loop back	Baseband characteristic: O/E Conv. and waveform	Baseband characteristic: E/O Conv.	Fiber evaluation: Fault location	Fiber evaluation: Splice loss	Etc.: Laser diode testing	Etc.: Etc.	Remarks	Page
Baseband characteristic measurement	ME96A/B/C Optical fiber transmission measuring set											●	●							0.85/1.3μm (ME96A) 0.85μm (ME96B) 1,3μm (ME96C)	155
	ME98A/B/C/D/E/F Optical fiber transmission measuring equipment												●							0.85 μm, 1.3μm, 0.85/1.3μm (100kHz to 1GHz, 100kHz to 50MHz)	159
Chromatic dispersion characteristic measurement	ME9301A Chromatic dispersion measuring set												●								163
Automatic LD test	ME9001A Automatic LD test system																	●			171
Waveform monitor	MP95A/MP96A Waveform monitor													●						0.5 to 1.1μm (MP95A) 1.0 to 1.6μm (MP96A)	177
Optical key box series	Attenuator unit, light switch unit and branch/coupling unit						●	●		●											179
Optical attenuator	MN95A/B Optical variable attenuator						●	●												0.85μm (MN95C) 1.3μm (MN95D)	181
	MN938/MN939A Programmable optical attenuator						●	●													186
	MN924A/MN934A/MN935A						●	●												1.3μm, 1.5μm/1.3μm/1.5μm	189
	MN925A Optical attenuator						●	●												0.66μm	190
	MN916A/B Optical variable step attenuator						●	●												0.85μm (MN916A) 1.3μm (MN916B)	191
	MP910□ Optical fixed attenuator						●	●												0.85μm	192
Optical channel selector	MN936A/MN937A Optical channel selector						●	●													193
Optical branch/coupling	MN919, MN920A Optical branch/coupling																		●		196
Base fiber connector	MP921B/MP922B Bare fiber connector																		●		197
Optical accessories	Optical fiber cord, adaptor, dummy fiber, optical fiber cutter, jacket stripper, mode scrambler																		●		199

● PCM measuring equipment

Instrument	Model No.	Clock frequency	Measuring range	Features	Page
Error Rate Measuring Equipment	ME448A	1kHz to 50MHz	Code: AMI, HDB3	For 30-channel PCM system	202
	ME448B/C		Code: AMI, etc.	For 24-channel PCM system	
DS-3 Transmission Analyzer	ME462B	1 to 50MHz	Code: B3ZS	Meets Bell System DS-3 requirements	208
Error Rate Measuring Equipment	ME518A	1kbit/s to 150Mbit/s	Code: CMI, AMI, HDB3, 4B3T	Meets CCITT Recommendation GP-IB (standard)	215
Digital Transmission Analyzer	ME520B	1kHz to 150MHz	Code: CMI, AMI, HDB3		219
Error Rate Measuring Equipment	ME522A	1MHz to 700MHz	Code: CMI, AMI		226
Error Rate Measuring Equipment	ME643A	50MHz to 2GHz			236

Continued on next page.

● **PCM measuring equipment (continued)**

Instrument	Model No.	Clock frequency	Measuring range	Features	Page
Pulse Pattern Generator	MP1601A	50 MHz to 5 GHz			243
1/4 Demultiplexer	MP1603A	2 GHz to 5 GHz			247

Optical Connector Options for Anritsu Optical Measuring Instruments

Various types of optical connectors are used in optical fiber communication systems in the world. Anritsu measuring instruments for optical fiber communication systems employ the FC-type (NTT specifications) optical connectors as standard features. Therefore, if model names only are specified when ordering, standard models equipped with FC-type connectors are supplied.

To order the optical measuring instruments with connectors the same type as those used in your (customer's) systems, please specify the option numbers along with the model names shown in the following tables. (pages 22 to 25).

As for the combinations marked with the symbol "○", we can supply the required instruments according to the order, but it is necessary to request and get approval when ordering other combinations with no "○" symbol (blank) and those which are not found in the table.

Especially for the optical connectors for single-mode fiber, be sure to consult with us before ordering, to avoid trouble with connectors not fitting.

Model			Connector Option Number									
			21	22	23	24	30	34	35	36	38	39
			NEC D4	Runge	Amphenol Type 906	Fujitsu OF-2	HP SMA	Diamond	Amphenol Type 906	F & G	ST	DIN
Light Sources	MG93B		○	○	○	○		○			○	○
	MG94B		○	○		○		○			○	○
	MG96A		○	○	○	○		○			○	○
	MG97B		○	○		○		○			○	○
	MG921A		○	○								
	MG922A		○	○	○	○		○		○	○	○
	MG923A		○	○								
	MG925A		○	○		○		○			○	○
	MG932A		○	○	○	○		○			○	○
	MG9301A											
	MG9801A											
	O/E unit	MG0901A										
	MGV5	MH916A	○	○	○	○		○			○	○
		MH917A	○	○	○	○		○			○	○
	MG99B				○						○	
	MG927A			○							○	

○ Available

Continued on next page.

(Continuted)

Model			Connector Option Number									
			21	22	23	24	30	34	35	36	38	39
			NEC D4	Runge	Amphenol Type 906	Fujitsu OF-2	HP SMA	Diamond	Amphenol Type 906	F & G	ST	DIN
Sensors for Optical Power Meters (ML93A/ ML94A/ML96B)	MA95A		○	○		○		○		○		○
	MA96E		○	○		○		○		○	○	○
	MA913E		○	○		○		○		○	○	○
	MA916A		○	○	○	○		○	○			
	MA917E		○	○		○		○				
Sensors for Optical Power Meter (ML910A)	MA9301A		○	○		○		○		○	○	○
	MA9304A		○	○		○		○		○	○	○
	MA9305A		○	○		○		○		○	○	○
	MA9801A		○	○		○		○		○	○	○
	MA9804A		○	○		○		○		○	○	○
Adaptors	MP92A		○	○	○	○		○	○	○		
	MP915A		○	○							○	○
	MA9001A		○	○	○	○		○	○			
Optical Wavelength Meter	MF91A		○	○		○		○			○	○
Optical Fiber Testers	MS94A		○	○							○	○
	MS97A		○	○							○	○
Optical Testers	MS93A		○								○	○
	MS95A		○	○								
Optical Portable Telephone	MS98A		○	○	○	○		○	○	○	○	○
Optical Return Loss Measuring Sets	MR91A		○	○							○	
	MR92A		○	○				○		○	○	
	MR93A											
Optical Spectrum Analyzer	MS99A		○	○	○						○	○
	Optical accessories	MA918A	○	○								
		M919A	○	○				○		○		
	MS9001A/A1		○	○				○		○		
	MS9003A		○	○				○		○		
	MS9003B											

○ Available

Continued on next page.

(Continued)

Model			Connector Option Number									
			21	22	23	24	30	34	35	36	38	39
			NEC D4	Runge	Amphenol Type 906	Fujitsu OF-2	HP SMA	Diamond	Amphenol Type 906	F & G	ST	DIN
Optical Time Domain Reflectometer	MW98A	MH913B	○	○				○		○		
		MH914C	○	○	○	○		○		○		
		MH925B	○	○				○		○		
		MH929B	○	○								
	MW910A	MH963A/A1										
		MH937A/A1	○	○	○	○		○		○		
		MH938A/A1	○	○				○		○		
		MH939A/A1	○	○				○		○		
		MH955A/A1	○	○				○		○		
	MW920A	MH951A	○	○				○		○		
		MH952A	○	○				○		○		
		MH958A										
E/O Converter	MG92A/B		○	○	○	○		○			○	
	MG912B		○	○	○	○		○			○	
	MG910A		○	○	○	○		○			○	
	MG911A		○	○	○	○		○			○	
O/E Converter	MH945A		○	○		○		○		○		
	MH922A		○	○		○		○				
	MH923A		○	○		○		○				
	MH946A		○	○		○		○		○		
Optical Fiber Transmission Measuring Sets	ME96A		○	○		○		○				
	ME96B		○	○		○		○				
	ME96C		○	○		○		○				
	Averanger	MH911A	○	○		○		○				
	ME98A		○	○		○		○				
	ME98B		○	○		○		○				
	ME98C		○	○		○		○				
	ME98D		○	○		○		○				
	ME98E		○	○		○		○				
	ME98F		○	○		○		○				
Chromatic Dispension Measuring Set	ME9301A											

○ Available

Continued on next page.

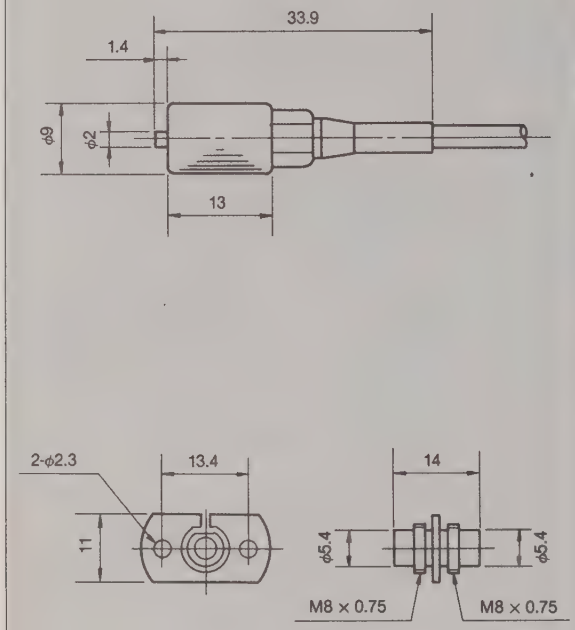
(Continued)

Model		Connector Option Number									
		21	22	23	24	30	34	35	36	38	39
		NEC D4	Runge	Amphenol Type 906	Fujitsu OF-2	HP SMA	Diamond	Amphenol Type 906	F & G	ST	DIN
Waveform Monitors	MP95A	○	○	○	○		○			○	○
	MP96A	○	○	○	○		○			○	○
Optical Attenuators	MN95C	○	○				○		○		○
	MN95D	○	○				○		○		○
	MN98A	○	○				○		○		○
	MN911A	○	○				○		○		○
	MN912A	○	○				○		○		○
	MN913A	○	○				○		○		○
	MN924A	○	○								○
	MN934A										
	MN935A										
	MN925A	○	○	○						○	○
	MN916A	○	○				○				○
	MN916B	○	○				○				○
	MP910□	○	○				○				○
	MN932A	○	○								○
	MN938A	○	○		○		○				○
	MN939A	○	○		○		○				○
Light Switch Unit	MN96A	○	○		○		○				
	MN99A	○	○		○		○				
	MN931A	○	○				○				
Optical Branch/ Coupling Units	MN97A	○	○								
	MN910A	○	○								
	MN919A		○								
	MN920A		○								
Optical Channel Selector	MN936A	○	○				○				
	MN937A	○	○				○				
Optical Fiber Cord for BB Measurement	—	○									
Dummy Fiber	—	○									
Mode Scrambler	MZ106□	○	○								

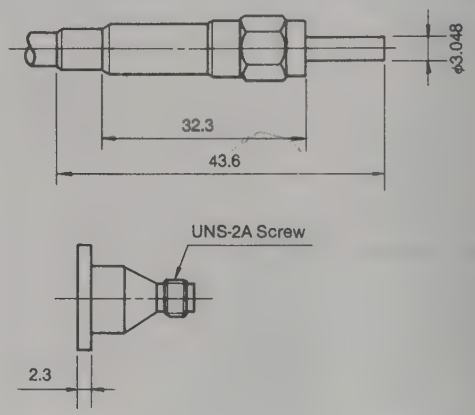
○ Available

(Unit in mm)

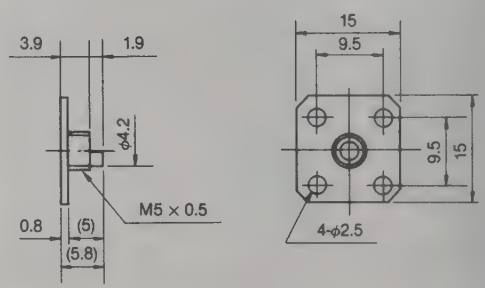
Option 21: Type D4 Connector



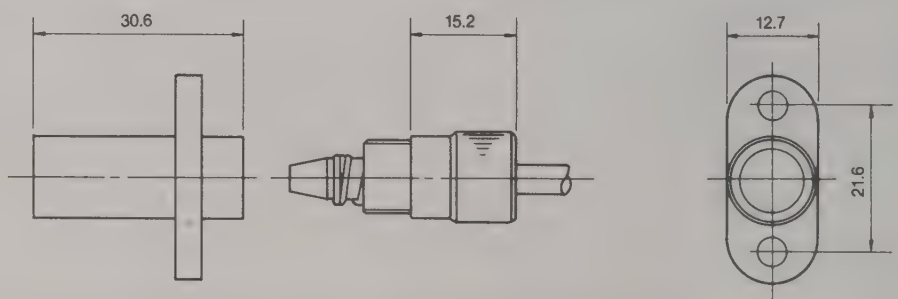
Option 23: Amphenol Type 906 Connector



Option 24: Fujitsu Type OF-2 Connector

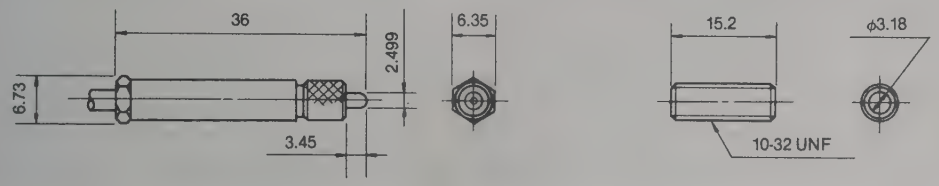


Option 22: Runge Connector

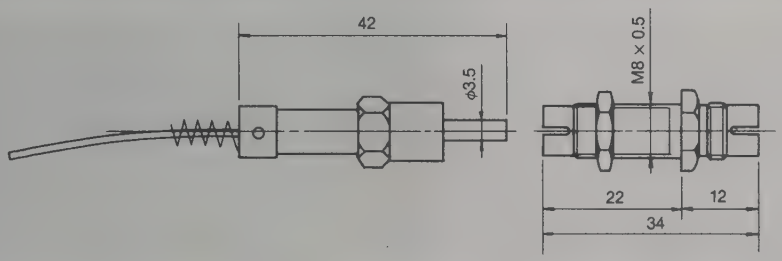


(Unit in mm)

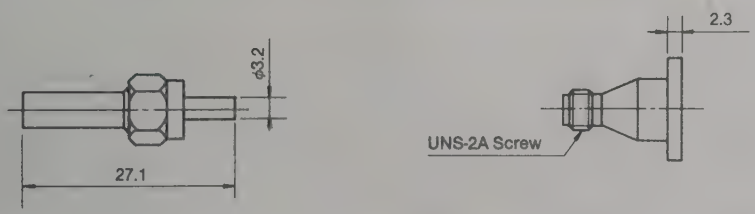
Option 30: HP SMA Connector



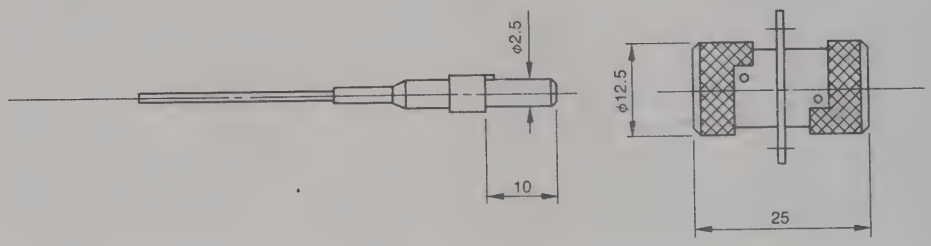
Option 34: Diamond Connector



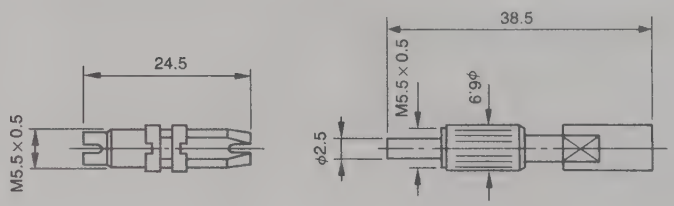
Option 35: Amphenol Type 905 Connector



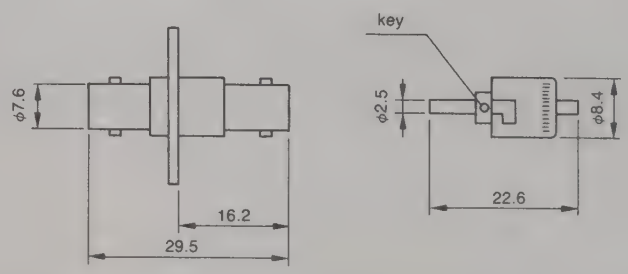
Option 36: F&G Connector



Option 38: ST



Option 39: DIN



Various light sources

It is essential that optical light sources also be used along with optical power meters, when measuring optical detector sensitivity, optical fiber loss, splicing loss, and insertion loss.
At Anritsu, we have developed a wide variety of light sources for the measurement of losses, including an LD type with a high output and narrow optical emission spectrum, a stabilized LED light source featuring high stability, and broadband halogen lamps. Furthermore, a visible light source using He-Ne gas laser is available for fracture point detection and fiber identifications.

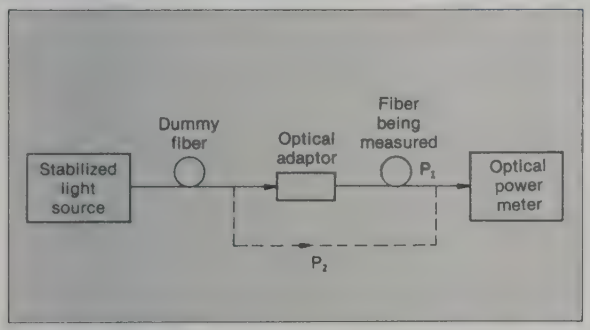
Selection guide

Model	Element	Wavelength (μm)	Optical output (dBm)	Applicable fiber	Power supply		Application	Remarks
					AC	DC		
MG94B	LD	0.85	−3	Multi-mode	●	●	Precision measurement	Elimination of reflected light
MG97B		1.3	−3	Multi-mode	●	●		
MG9801A		0.85	+5	Multi-mode	●			Modulation function is provided
MG9301A		1.3	0	Multi-mode	●			
MG921A		1.3	−6	Multi-mode, Single-mode	●			Modulation function is provided (INT/EXT)
MG923A		1.55	−6	Mulit-mode, Single-mode	●			
MG93B	LED	0.85	−13	Multi-mode	●	●		
MG96A		1.3	−20	Multi-mode, (Single-mode)	●	●		
MG932A		1.55	−23	Multi-mode, Single-mode	●	●		
MG925A		1.3	−35/−50	Multi-mode, Single-mode	●			Optical filter included*1
MGV5		0.85/1.3	−13/−20	Multi-mode	●			*2
MG927A		0.66	−10	Plastic fiber	●	●		Visible light source (Handy type)
MG99B	He-Ne laser	0.633	−8/−15	Multi-mode, Single-mode	●		Simple fault location	Visible light source
MG922A	Halogen lamp	0.6 to 1.6	−45	Multi-mode	●		Loss-wavelength characteristics in optical fibers	

*1 As the emitting light spectrum of LEDs is wide and may spread into the high loss range of the optical fiber, optical filters are used to limit the width of wavelength, making high precision loss measurements possible.
*2 A combination of the MZ113A (Main Frame), MH916A (0.85 μm), and MH917A (1.3 μm). A maximum of 6 units may be mounted.

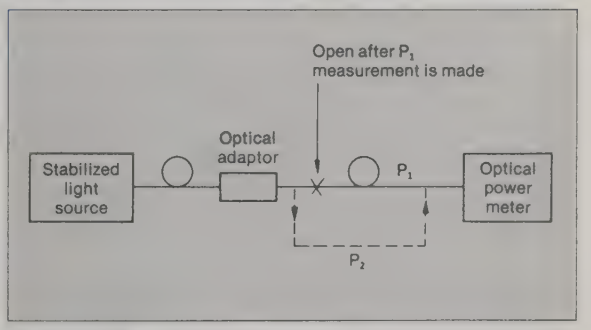
Applications

● **Measurement of optical connection loss**

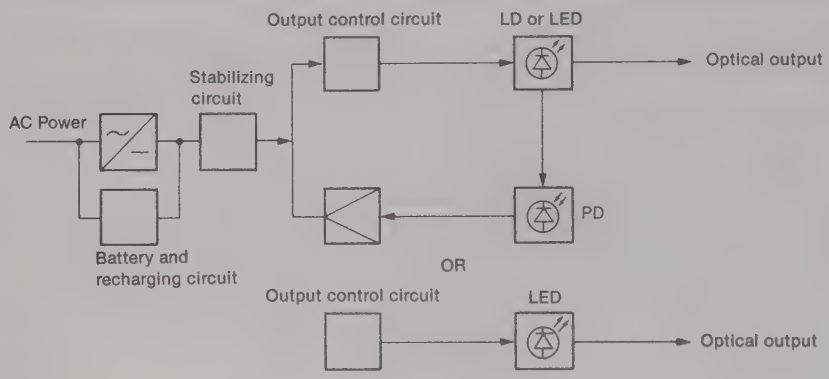


Optical loss of fiber being measured (Connection loss included) $P = P_2 - P_1$ (dB)

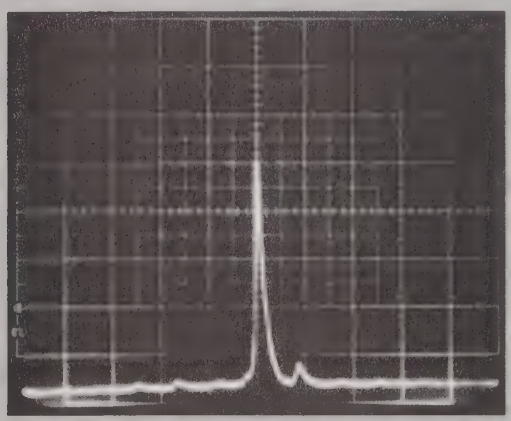
● **Measurement of optical loss by the cutback method**



Optical loss of fiber being measured (Connection loss not included) $P = P_2 - P_1$ (dB)

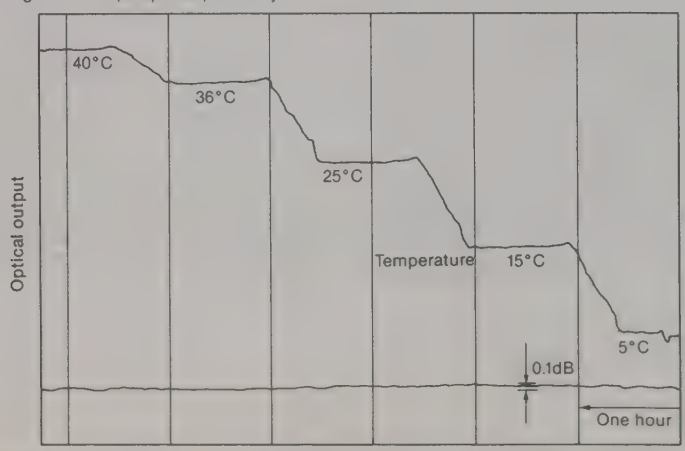


Block Diagram



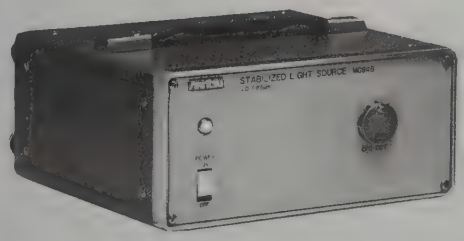
Spectrum of LD Light Source

Light Source (0.85μm LD) Stability

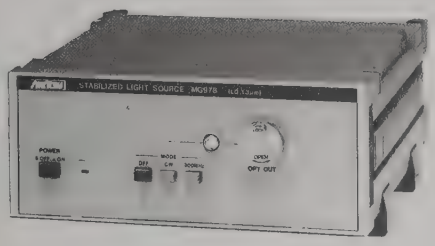


Stabilized Light Source
MG94B/MG97B

0.85/1.3 μm LD



MG94B



MG97B

Features

- For use for multi-mode fibers with wavelengths of 0.85 μm (MG94B) and 1.3 μm (MG97B).
- Superior temperature stability and short-term stability.
- Elimination of reflected light by Anritsu's original method.
- Battery operation possible (internal battery is standard).

Description

Compatible with multi-mode fiber (50/125 μm, NA 0.2), it is a stabilized light source for 0.85 μm (MG94B) and 1.3 μm (MG97B) wavelengths. A high-stability output is achieved through the use of APC (Automatic Power Control) detecting a portion of the optical output. It is designed for the complete suppression of reflected light levels. It is possible to adjust a 300 MHz control on the MG97B to suppress speckle noise. Furthermore, the inclusion of a battery enables usage in locations where there is no AC power source.

Specifications

- **MG94B/MG97B**

Model	MG94B	MG97B*8
Element	LD	LD
Wavelength*1	0.85 ±0.01 μm	1.3 ±0.02 μm
Spectral bandwidth*1	≦0.003 μm	
Optical output*2	−3 ±1dBm	
Output stability*3	≦0.2 dB	
Short term stability*4	≦0.02 dB	
Connector	FC type*5	
Ambient temperature, rated range of use	0 to 40°C	
Power	*6 100V $^{+10\%}_{-15\%}$, 50/60 Hz, ≦10 VA, *7 rechargeable battery is incorporated	
Dimensions and weight	95H, 210W, 200Dmm, ≦3.5kg	88H, 213W, 251Dmm, ≦4kg

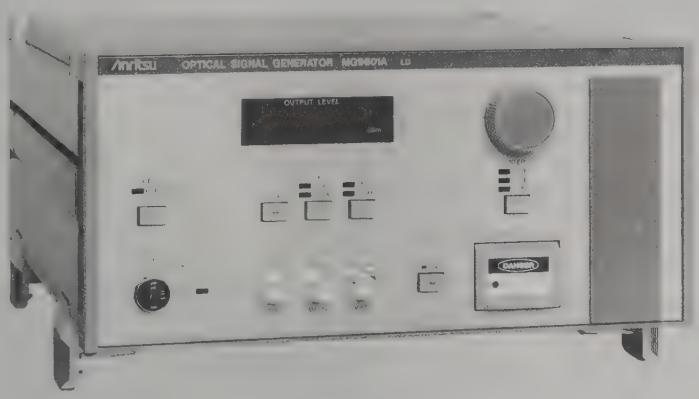
*1 25°C
*2 When 2 m of multi-mode fiber (50/125 μm, NA 0.2) produced by Anritsu is connected.
*3 10 to 35°C within 5 hours.
*4 For one minute, at a constant temperature of 20 ±10°C.
*5 The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.
*6 Specify one nominal AC line voltage between 100 V and 250 V when ordering.
*7 Can be used for 10 hours (recharging time: 20 hours).
*8 CW output

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MG94B	Stabilized Light Source		0.85 μm LD
	Standard accessories		
	Fuse for MG94B, 0.5 A:	1 pc	MF61NN250V0.5AAC05
	Fuse for MG94B, 1.6 A:	1 pc	MF61NN250V1.6ADC01
	MG94B Operation Manual:	1 copy	
	Main frame		
MG97B	Stabilized Light Source		1.3 μm LD
	Standard accessories		
J0017	Power cord, 2.5 m:	1 pc	
	Fuse for MG97B, 0.5 A:	1 pc	MF61NN250V0.5AAC05
	Fuse for MG97B, 1.6 A:	1 pc	MF61NN250V1.6ADC01
	MG97B Operation Manual:	1 copy	
	Optional accessories		
J0200B	Optical fiber cord, 2 m		For GI fiber

Optical Signal Generator
MG9801A/MG9301A



MG9301A

《GP-IB》

Features

- High optical output (+5 dBm/0.85 μm, 0 dBm/1.3 μm)
- Optical output level can be controlled externally via GP-IB
- Intensity modulation of analog or digital signals is available
- O/E unit (sold separately) for waveform monitoring. This unit enables observation of baseband signals when used in combination with an oscilloscope.

Applications

- Calibration and linearity check of optical sensor
- Optical loss measurement on optical fibers and devices
- Bit error rate measurement on fiber optic transmission system such as optical LAN

Description

Optical Signal Generator MG9801A/MG9301A provide optical output of variable level and optical modulation function for analog or digital signals. Their optical output level can be controlled manually using an encoder driving knob on the panel or remotely via its GP-IB interface. The MG9801A/MG9301A are applicable to GI fibers (50/125 μm, NA 0.2). Usable wavelength bands are 0.85 μm for MG9801A and 1.3 μm for MG9301A.

Applications include optical loss measurement on optical fibers or optical devices, calibration/linearity check of optical sensor, and usage as an E/O converter for bit error rate measurement on optical LAN as well. As an additional component unit, the MG0901A O/E unit is available. Therefore, it is possible to monitor optical signals when used in combination with an oscilloscope.

Specifications

Model			MG9801A	MG9301A	Remarks
Element			LD		
Wavelength			0.85±0.01 μm	1.3±0.02 μm	at 25°C
Spectral bandwidth			≦0.002 μm	≦0.005 μm	CW
Optical output*1	Range		+5 to −55 dBm	0 to −60 dBm	CW
	Accuracy		±1 dB (±1.5 dB)		CW
	Stability		±0.2 dB (±0.7 dB)		CW, 5H
	Short-term stability		0.05 dB (±0.1 dB)		at a constant temperature, 1 minute
	Setting resolution		0.1 dB		
External modulation	Analog	0 to 1 V input	Voltage range: 0 to 1V, 75 Ω, BNC		
		Optical output	Level flatness: 1.5 dB		DC to 150 MHz
	Digital	0/−1 V input	Voltage range: 0 to −0.2 V/−0.8 to −1 V, 75 Ω, BNC		Rise/fall time: <1 ns
		Optical output	Rise/fall time: ≦2.5 ns		10 to 90%
		0/+5 V input	Voltage range: 0 to +0.5/+1.5 to +6V, 1 kΩ, BNC		Rise/fall time: <1 ns DC to 30 MHz
		Optical output	Rise/fall time: ≦ 2.5 ns		10 to 90%
Internal modulation	270Hz	Frequency	270 Hz ±1%		
		Duty factor	50±10%		
		Monitor output	0 to +0.5/+4 to 6 V, 10 kΩ, BNC		
	150 MHz	Frequency	150 MHz±0.1%		
		Duty factor	50 ±10%		
		Rise/fall time	≦2.5 ns		
Remote control			GP-IB: Conforms to IEEE-488 1978. 24-contacts connector Interface: SH1, AH1, L4, T8, RL1 All functions except for the power switch and the STEP selection switch can be controlled.		
Optical connector*2			PC type		
Ambient temperature, rated range of use			0 to 40°C		
Power			AC 100 $^{+10}_{-15}$ V, 50/60 H, ≦70 VA		
Dimensions and weight			132.5 H, 284 W, 351 D mm, ≦10 kg		

*1 When 2m of an Anritsu GI-PC fiber cable (50/125 μm, NA 0.2) is connected. Values within parentheses are those of specification when FC-type connectors are used.
*2 Standard optical connector is PC type. For other connectors please consult the nearest Anritsu representative.

Specifications (Optional Unit)

Name	MG0901A O/E unit	Remarks
Demodulation frequency	DC to 150 MHz	
Demodulation output	≧0.3 V/0.85 μm, ≧0.8 V/1.3 μm, 75 Ω, BNC	−10 dBm (optical input)
Optical connector*3	FC type	
Ambient temperature, rated range of use	0 to 40°C	
Dimensions and weight	113 H, 34 W, 90 D mm, ≦300 g	

*3 PC-type connectors are also available. For connector modification please consult the nearest Anritsu representative, when ordering.

Front panel

Level display

Indicates output level.

CW switch

Selects the unmodulated output.

INT switch

Selects the internal modulation frequency. The frequency is switched between 270 Hz and 150 MHz on every push.

EXT switch

Selects the type of external modulation signal. The type is switched between analog and digital on every push.

REMOTE lamp

Comes on when remote control condition is set.

LOCAL switch

Releases remote control.

POWER switch

ANALOG signal input connector

Input terminal of analog modulation signals ranging from 0 to 1 V.

DIGITAL signal input connector (0/−1 V)

Input terminal of digital modulation signals with 0/−1 V amplitude.

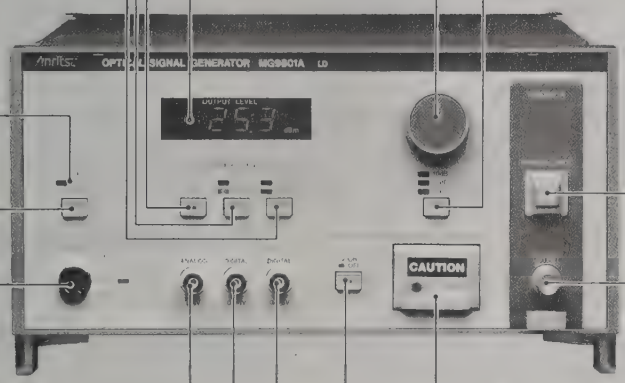
DIGITAL signal input connector (0/+5 V)

Output level control knob

Internal rotary encoder can be driven through this knob.

STEP selection switch

Selects the step size of output level control.



O/E converter input

O/E converter output

Optical signals are converted into electrical signals and are put out.

Optical output connector

Optical output signals of selected level are taken out.
The lid marked "CAUTION" must be lifted for output connection.

Optical output switch

Optical output is not supplied until this switch is turned on.

Rear panel

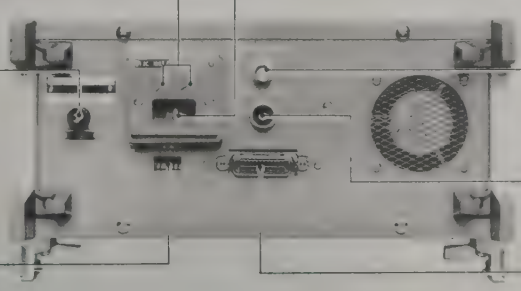
Fuses

GROUND terminal

Be sure to ground this terminal to avoid troubles on measurement.

ADDRESS switch

Sets the address of this unit when controlled via GP-IB.



AC power input connector

Used for AC mains connection.

MONITOR output

Used for monitoring internal 270 Hz modulation signal with 0/+5 V amplitude.

REMOTE CONTROL terminal

Used for remote ON/OFF control of optical output.

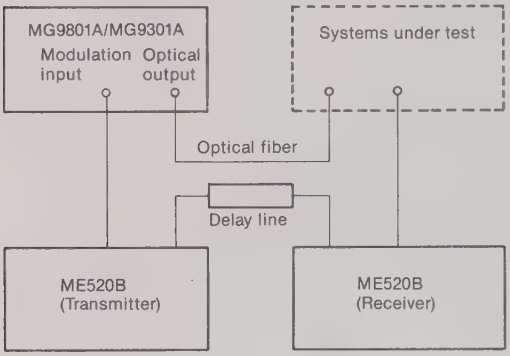
GP-IB connector

Used for reception of control data via GP-IB.

Applications

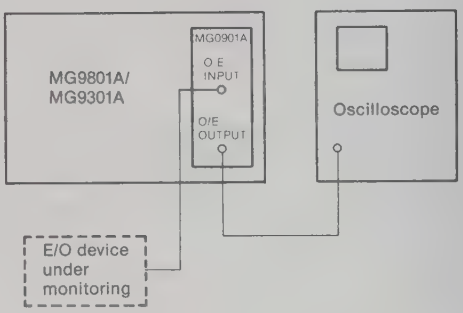
● Error rate measurement

Besides the application on optical loss measurement, the MG9801A/MG9301A can also be used for PCM error rate measurement on optical communication systems in combination with an electrical error rate measuring equipment such as the ME520B.



● Waveform monitoring

Waveforms of optical signals can be monitored using the O/E Unit MG0901A (sold separately) and an oscilloscope.



Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MG9801A	Optical Signal Generator		
MG9301A	Optical Signal Generator		
	Standard accessories		
J0017	AC power cord, 2.5 m:	1 pc	
	Fuse for MG9801A/MG9301A, 3.15 A:	2 pcs	T3.15A250V
	Fuse for MG9801A, 2 A:	3 pcs	MF51NN250V2ADC01
	Fuse for MG9301A, 2A:	4 pcs	MF51NN250V2ADC01
	Fuse for MG9801A/MG9301A, 1 A:	2 pcs	MF51NN250V1ADC01
	Fuse for MG9801A/MG9301A, 0.8 A:	1 pc	MF51NN250V0.8ADC01
	Fuse for MG9801A/MG9301A, 0.5 A:	2 pcs	MF51NN250V0.5ADC01
	Operation manual:	1 copy	
	Units		
MG0901A	O/E Unit		
	Optional accessories		
	Optical cord (GI-PC), 2m		

Stabilized Light Source
MG921A/MG923A

1.3/1.55 μm LD

MG921A

MG923A

Features

- For use with multi-mode/single-mode fibers of 1.3 μm (MG921A) and 1.55 μm (MG923A) wavelengths.
- The 1.55 μm light source (MG923A).
- Unprecedented light output level and wavelength stability through use of APC and temperature control circuits.
- Internal and external modulation functions are provided, permitting removal of stray light.

Description

This is a light source suitable for multi-mode fiber (50/125 μm, NA 0.2) and single-mode fiber (10/125 μm, NA 0.1). The wavelength is 1.3 μm for the MG921A and 1.55 μm for the MG923A.

The MG923A is the light source with a wavelength of 1.55 μm and employs a light emitting device that was developed at Anritsu. Stability is outstanding due to the employment of a temperatrure control unit in the LD module and an APC circuit for increasing the output level and the wavelength stability. Furthermore, when removing stray light and using the lock-in-amplifier, the necessary internal (270 Hz) and external (DC to 3 kHz) modulation can be applied.

Specifications

- **MG921A/MG923A**

Model		MG921A	MG923A
Element		LD	
Wavelength		1.3 ±0.02 μm	1.55 ±0.03 μm
Spectral bandwidth		<0.005 μm	<0.01 μm
Output 1 *1		≧ −6 dBm	
Output 2 *2		≧ −6 dBm	
Output stability 1 (connector output)		≦ 0.2 dB	
Output stability 2 (fiber output)		≦ 1 dB	
Short term stability *3		≦ 0.05 dB	
Modulation	Int.	270 Hz ±1% (Duty 50%), Monitor out: 6 ±1 Vp-p (100 kΩ load)	
	Ext.	DC to 3 kHz, 0/+2 to 0/+10 Vp-p (square wave), connector: BNC	
Connector		FC type *4	
Power		100 V $^{+10\%}_{-15\%}$, 50/60 Hz, ≦ 50 VA *5	
Dimensions and weight		95H, 210W, 250D mm, ≦ 5 kg	88H, 213W, 251D mm, ≦ 5 kg

*1 When 2 m of multi-mode fiber (50/125 μm, NA 0.2) produced by Anritsu is connected.
*2 When 2 m of single-mode fiber (10/125 μm, NA 0.1) produced by Anritsu is connected.
*3 For one minute, at a constant temperature of 20±10°C.
*4 The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.
*5 Specify one nominal AC line voltage between 100 V and 250 V when ordering.

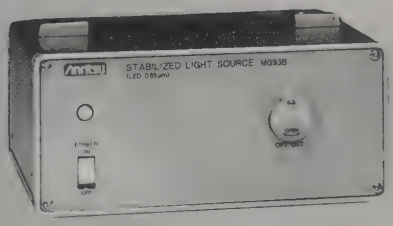
Ordering Information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MG921A	Stabilized Light Source		1.3 μm LD
	Standard accessories		
J0017	Power cord, 2.5 m:	1 pc	
	Fuse for MG921A, 2A:	2 pcs	MF51NN250V2AAC05
	Fuse for MG921A, 2A:	1 pc	MF51NN250V2ADC01
	MG921A Operation manual:	1 copy	
	Main Frame		
MG923A	Stabilized Light Source		1.55 μm LD
	Standard accessories		
J0017	Power cord, 2.5 m:	1 pc	
	Fuse for MG923A, 2A:	2 pcs	MF51NN250V2AAC05
	Fuse for MG923A, 2A:	1 pc	MF51NN250V2ADC01
	Fuse for MG923A, 1A:	1 pc	MF51NN250V1ADC01
	MG923A Operation manual:	1 copy	
	Optional accessories		
J0056B	Optical fiber cord, 2 m		For SM fiber
J0200B	Optical fiber cord, 2 m		For GI fiber

Stabilized Light Source
MG93B/MG96A/MG932A

0.85/1.3/1.55 μm LED



MG93B

MG932A

Features

- For use with GI fiber with wavelengths of 0.85 μm (MG93B) and 1.3 μm (MG96A).
- For use with GI/SM fiber with wavelengths of 1.55 μm (MG932A)
- Stabilized optical output achieved through the employment of an APC (Automatic Power Control) circuit and a termperature compensation circuit.
- Battery operation possible (internal battery standard).

Description

These are stabilized light sources suitable for GI fiber (50/125 μm, NA 0.2) at wavelengths of 0.85 μm (MG93B) and 1.3 μm (MG96A) and for GI/SM fiber in 1.55 μm band (MG932A). High optical output stability has been achieved by use of an APC (Automatic Power Control) circuit that detects a portion of the optical output in the MG93B and a temperature compensation circuit in the MG96A and MG932A. Moreover the internal battery allows usage in locations where no AC power sources are available. MG96A/MG932A is capable of an output of about −38 dBm when single-mode fiber (10/125 μm, NA 0.1) is employed.

Specifications

- **MG93B/MG96A/MG932A**

Model	MG93B	MG96A	MG932A
Element	LED		
Applicable fiber	GI fiber		GI/SM fiber
Wavelength*1	0.85 ± 0.015 μm	1.3 ± 0.03 μm	1.55 ± 0.03 μm
Spectral bandwidth*1	≦ 0.05 μm	≦ 0.13 μm	≦ 0.21 μm
Optical output*2	− 13 ± 1 dBm	− 20 ± 1 dBm	≧ − 23 dBm
Optical output*3	—		≧ − 43 dBm
Output stability*4	≦ 0.1 dB		
Short-term stability*5	≦ 0.02 dB		
Connector*6	FC type		
Ambient temperature, rated range of use	0 to 40°C		
Power	*7 100 V $^{+10}_{-15}$%, 50/60 Hz, ≦ 10 VA, *8 rechargeable battery is incorporated.		
Dimensions and weight	95 H, 210 W, 200 D mm, < 3.5 kg		88 H, 213 W, 351 D mm, < 4 kg

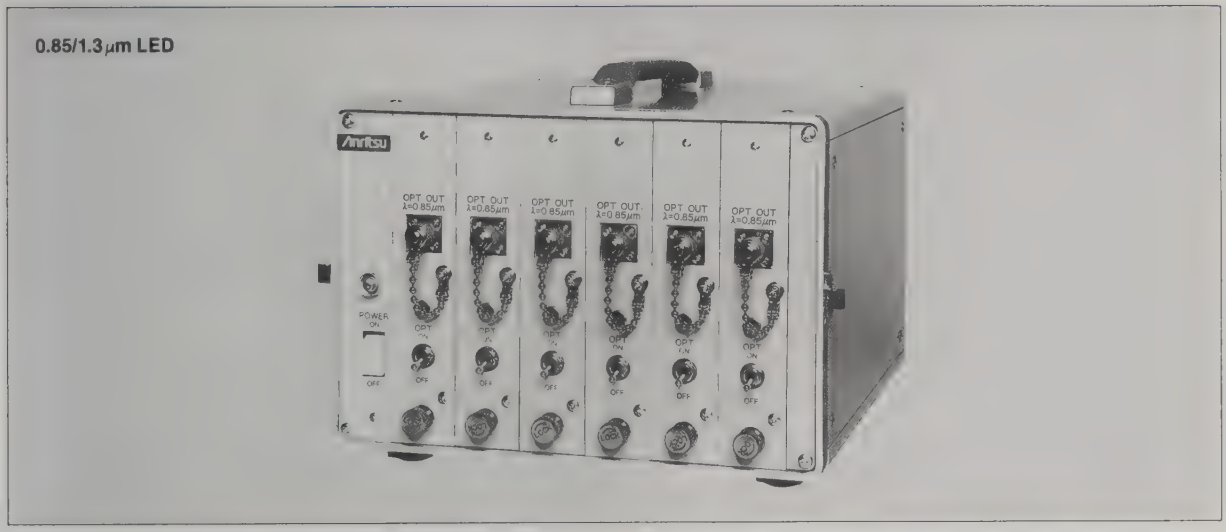
*1 25°C
*2 When 2 m of multi-mode fiber (50/125 μm, NA 0.2) produced by Anritsu is connected.
*3 When 2 m of single-mode fiber (10/125 μm, NA 0.1) produced by Anritsu is connected.
*4 10 to 35°C within 5 hours.
*5 For one minute, at a constant temperature of 20 ± 10 °C.
*6 The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.
*7 Specify one nominal AC line voltage between 100V and 250V when ordering.
*8 Can be used for 10 hours (recharging time: 20 hours).

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MG93B	Stabilized Light Source		0.85 μm LED
	Standard accessories		
	Fuse for MG93B, 0.5 A:	1 pc	MF61NN250V0.5AAC05
	Fuse for MG93B, 1.6 A:	1 pc	MF51NN250V1.6ADC01
	MG93B Operation Manual:	1 copy	
	Main frame		
MG96A	Stabilized Light Source		1.3 μm, LED
	Standard accessories		
	Fuse for MG96A, 0.5 A:	1 pc	MF61NN250V0.5AAC05
	Fuse for MG96A, 1.6 A:	1 pc	MF51NN250V1.6ADC01
	MG96A Operation manual:	1 copy	
	Main frame		
MG932A	Stabilized Light Source		1.55 μm, LED
	Standard accessories		
J0017	Power cord, 2.5 m:	1 pc	
	Fuse for MG932A, 0.5 A:	2 pcs	MF51NN250V0.5AAC05
	Fuse for MG932A, 1 A:	1 pc	MF51NN250V1ADC01
	MG932A Operation manual:	1 copy	
	Optional accessories		
J0056B	Optical fiber cord, 2 m		For SM fiber
J0200B	Optical fiber cord, 2 m		For GI fiber

Stabilized Light Source
MGV5



Features

- A maximum of six stabilized light source units can be used together (0.85 μm and 1.3 μm wavelengths).
- Convenient for the loss measurement of multiple-conductor optical fibers.

Description

This is a stabilized light source suitable for multi-mode optical fiber (50/125 μm, NA 0.2). The MZ113A Main Frame can mount up to six individual light sources with any combination of MH916A (wavelength 0.85 μm) and MH917A (wavelength 1.3 μm). It can effectively measure the optical losses of multiple-conductor optical fibers. Each unit has the same outstanding stability as the MG93B and MG96A.

Specifications

- **MGV5**

(1) Stabilized light source units (MH916A/MH917A)

Model	MH916A	MH917A
Element	LED	LED
Wavelength*1	0.85 ±0.015 μm	1.3 ±0.03 μm
Wavelength half width*1	≤0.05 μm	≤0.14 μm
Output*2	−13 ±1dBm	−20 ±1dBm
Output stability*3	≦0.1dB	
Short-term stability *4	≦0.02dB	
Connector*5	FC type	
Ambient temperature, rated range of use	0 to 40°C	

*1 25°C
*2 When 2 m of multi-mode fiber (50/125 μm, NA 0.2) produced by Anritsu is connected.
*3 10° to 35°C within 5 hours
*4 For one minute, at a constant temperature of 20 ±10°C.
*5 FC-type output connector is standard. If other connector is necessary, please contact us.

(2) Main frame (MZ113A)

Max. number of units	6
Compatible units	MH916A, MH917A
Ambient temperature, rated range of use	0 to 40°C
Power*1	100V $^{+10\%}_{-15\%}$, 50/60 Hz, ≤20 VA
Dimensions and weight	145H, 210W, 250D mm, ≤6.5 kg

*1 Specify one nominal AC line voltage between 100 V and 250 V when ordering.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MZ113A	Stabilized Light Source Main Frame		
	Standard accessories		
J0017	Power cord, 2.5 m:	1 pc	
	Fuse for MZ113A, 0.5 A:	2 pcs	MF51NN250V0.5AAC05
	MGV5 Operation manual:	1 copy	
	Plug-in units		
MH916A	Stabilized Light Source Unit		0.85 μm LED
MH917A	Stabilized Light Source Unit		1.3 μm LED
	Optional accessories		
J0200B	Optical fiber cord, 2 m		For GI fiber

Stabilized Light Source
MG925A

1.3 μm LED

Features

- For use with multi-mode fiber and single-mode fiber with a wavelength of 1.3 μm.
- Limited to a wavelength spectrum halfwidth of 20 nm through use of an internal optical filter.

Description

This is a stabilized light source suitable for use with multi-mode optical fiber (50/125 μm, NA 0.2) and single-mode optical fiber (10/125 μm, NA 0.1). The optical emitter is an LED, but an internal optical filter is employed to limit the wavelength range, preventing spread into the optical fiber high loss range, and permitting precision measurement of losses at 1.3 μm.

Specifications

- **MG925A**

Element	LED
Wavelength	1.3 ±0.01 μm
Spectral bandwidth	≦0.02 μm
Output 1 *1	≧−35 dBm
Output 2 *2	≧−50 dBm
Output stability (fiber output) *4	≦ 0.2 dB
Short-term stability *3	≦0.02 dB
Connector *5	FC type
Power *6	100 V $^{+10\%}_{-15\%}$, 50/60 Hz, ≦50 VA
Dimensions and weight	95H, 210W, 250Dmm, ≦5kg

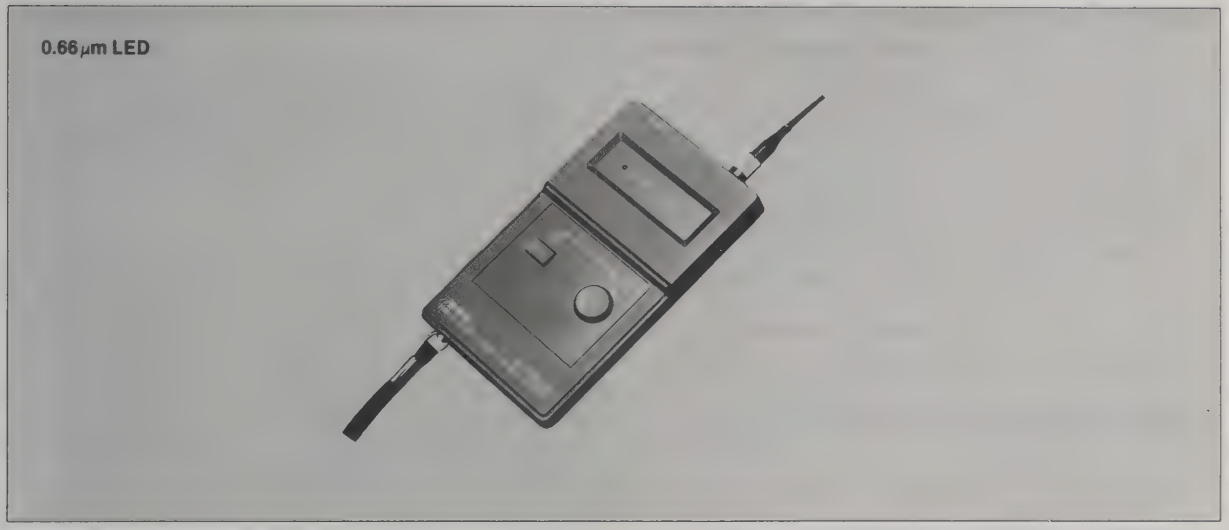
*1 When 2 m of multi-mode fiber (50/125 μm, NA 0.2) produced by Anritsu is connected.
*2 When 2 m of single-mode fiber (10/125 μm, NA 0.1) produced by Anritsu is connected.
*3 For one minute, at a constant temperature of 20 ±10°C.
*4 10 to 35°C within 5 hours.
*5 FC-type output connector is standard. If other connector is necessary, please contact us.
*6 Specify one nominal AC line voltage between 100 V and 250 V when ordering.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MG925A	Stabilized Light Source		1,3 μm LED, For both GI/SM fiber
	Standard accessories		
	Fuse for MG925A, 2 A:	1 pc	MF51NN250V2AAC05
	Fuse for MG925A, 1.6 A:	1 pc	MF51NN250V1.6ADC01
	MG925A Operation manual:	1 copy	
	Optional accessories		
J0200B	Optical fiber cord		For GI fiber
J0056B	Optical fiber cord		For SM fiber

Stabilized Light Source
MG927A



Features

- A light source for plastic fiber
- Compact design weighing only 250 g
- Battery operated

Description

This is a light source with a wavelength of 0.66 μm for plastic optical fiber and weighs merely 250 g. It employs temperature compensation for increasing output level stability. Besides operation on AC power source, it can operate on its own battery (battery charger attached).

Specifications

- **MG927A**

Element	LED
Wavelength*1	0.66 ±0.03 μm
Spectral bandwidth*1	≦0.05 μm
Optical output*2	≧−10 dBm
Output stability*3	≦0.4 dB
Short-term stability*4	≦0.05 dB
Connector*5	FC type
Ambient temperature, rated range of use	0 to 40°C
Power	*6 100V $^{+10\%}_{-15\%}$, 50/60 Hz, ≦10 VA, *7 rechargeable battery is incorporated.
Dimensions and weight	150H, 85W, 28Dmm, ≦ 1 kg

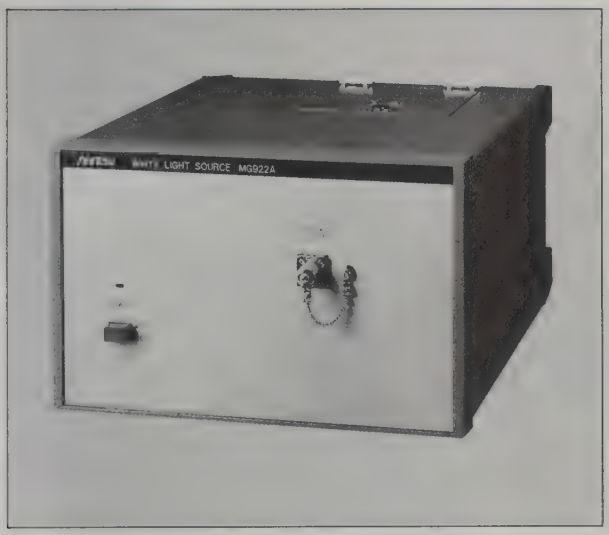
*1 25°C
*2 When plastic fiber (1 mmϕ, NA 0.5) is connected.
*3 10 to 35°C within 5 hours.
*4 For one minute, at a constant temperature of 20 ±10°C.
*5 The optical connector of the standard product is FC.
Consult us should you need modification of the optical connector.
*6 Specify one nominal AC line voltage between 100 V and 250 V when ordering.
*7 Can be used for 10 hours (recharging time: 20 hours).

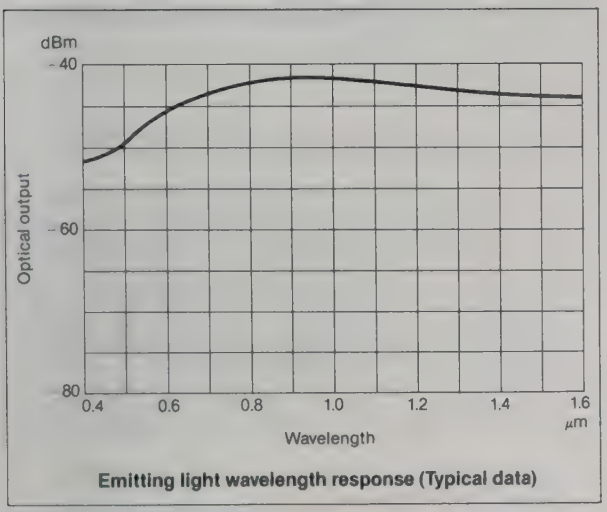
Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MG927A	Stabilized Light Source		0.66 μm LED
	Standard accessories		
G0016	Battery Charger:	1 pc	
	MG927A Operation manual:	1 copy	
	Optional accessories		
MP915A-01	Fiber Adaptor		For fibers with 1 mm diam.

White Light Source
MG922A





Emitting light wavelength response (Typical data)

Features

- Wide bandwidth (0.6 to 1.6 μm)
- Optical power is more than −45 dBm/10 nm

This light source employs a halogen lamp to achieve a broad wavelength range (0.6 to 1.6 μm). An internal APC circuit stabilizes the output level by detecting a portion of the light output. When used with the Optical Spectrum Analyzer (MS96A), measurement of light losses and loss-wavelength characteristics are possible.

Specifications

- **MG922A**

Element	Halogen lamp
Wavelength	0.6 to 1.6 μm
Output*1	>−45 dBm/10 nm
Output stability	< 0.3 dB (within 10 minutes)
Connector*2	FC type
Power	AC 100 V ±10 %, 50/60 Hz, <160 VA
Ambient temperature, rated range of use	0 to 40°C
Dimensions and weight	133H, 213W, 250D mm, <7 kg

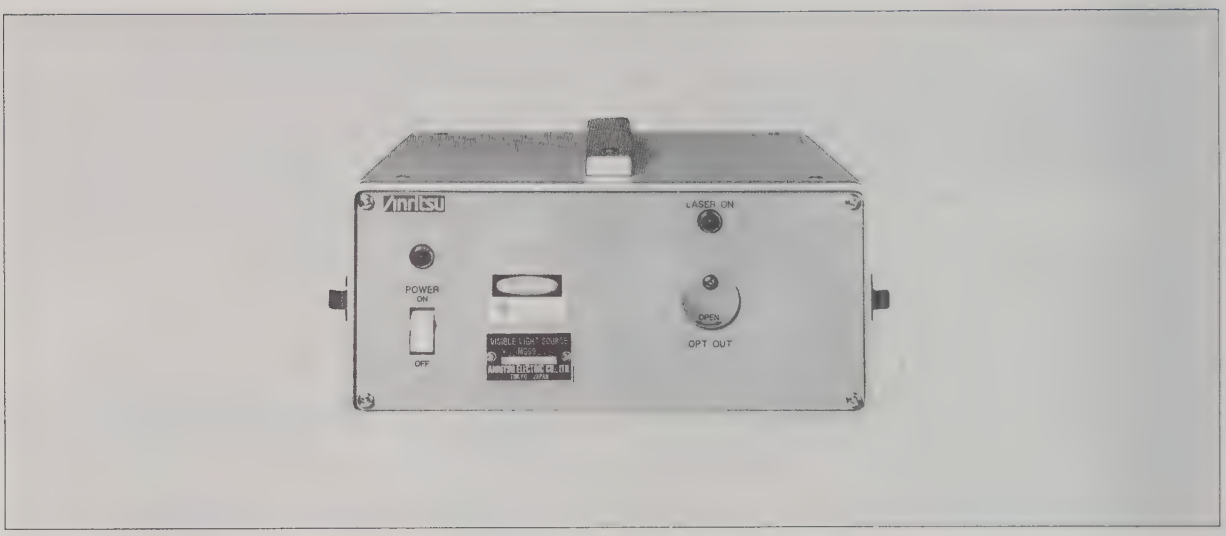
*1 When 2 m of multi-mode fiber (50/125 μm, NA 0.2) produced by Anritsu is connected.
*2 FC-type output connector is standard. If other connector is necessary, please contact us.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MG922A	White Light Source		0.6 to 1.6 μm
	Standard accessories		
J0017	Power cord, 2.5 m:	1 pc	
Z0048	Lamp (Spare):	1 pc	
	Fuse for MG922A, 3.15 A:	2 pcs	MF51NN250V3.15AAC05
	MG922A Operation manual:	1 copy	
	Optional accessories		
J0200B	Optical fiber cord, 2 m		For GI fiber

Visible Light Source
MG99B



Features

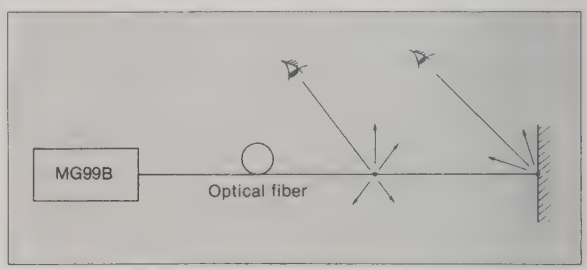
- High output power: more than −8dBm when connected to multi-mode optical fiber and more than −15dBm when connected to single-mode optical fiber.
- Employs a stable wavelength, visible light gas laser.
- Has a safety function that permits laser output generation only when the optical connector is connected.

Description

Usable with either multi-mode or single-mode optical fiber, this light source employs a visible light He-Ne gas laser with a wavelength of 0.633 μm. Optical fiber pairs and optical fiber fracture points in multi-conductor optical cables can be identified by eye. Furthermore, as a laser light is generated only when the optical connector is connected, complete safety is guaranteed.

Applications

- Visual identification of fault points in optical fibers
- Visual identification of the light path in optical devices
- Multi-core conductor fiber cable pair identification
- For wavelength calibration (0.6328 μm)



The minimum optical level for visual identifications is approximately −60dBm.

Specifications

● MG99B

Output	> −8dBm*1, > −15dBm*2
Wavelength	0.6328 ±0.002 μm
Ambient temperature, rated range of use	10 to 40°C
Connector*3	FC type
Power*4	AC100V $^{+10\%}_{-15\%}$, 50/60 Hz, ≦50 VA
Dimensions and weight	95H, 210W, 250D mm, ≦ 4.5 kg

*1 When 2m of multi-mode fiber (50/125 μm, NA 0.2) produced by Anritsu is connected.
*2 When 2m of single-mode fiber (10/125 μm, NA 0.1) produced by Anritsu is connected.
*3 FC type output connector is standard. If other connector is necessary, please contact us.
*4 Specify one nominal AC line voltage between 100V and 250V when ordering.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MG99B	Visible Light Source		0.633 μm, He-Ne laser
	Standard accessories		
	Fuse for MG99B, 2 A:	1 pc	MF61NN250V2AAC05
	MG99B Operation manual:	1 copy	
	Optional accessories		
J0200B	Optical fiber cord, 2 m		For GI fiber
J0056B	Optical fiber cord, 2 m		For SM fiber

Optical power meters are indispensible to the measurement of optical communication systems. Anritsu's power meters consist of an indicator (the main frame) and an optical power sensor, and have superior detection sensitivities and stabilities. Both analog and digital indicators are available. Seven types of optical power sensors are provided to match the customer's wavelength range, power range, optical reception technology, etc.; all the optical power sensors can be connected to the display unit without adjustments.

	Digital display	Analog display	Automatic ranging	Calibration input	Averaging	Relative level measurement	Output for recording device	AC	Internal battery	GP-IB
ML910A	●		●	●	●	●	●	●	*2	●
ML93B	●		●	●	●	●	●	●	*1	●
ML94A		●		●			●	●	●	
ML96B	●		●			●			●	

*1 Can be connected to the optional MZ95A Battery Pack.
*2 Can be connected to the external battery pack.

Selection Guide

Combinations of optical power meters and sensors

		Optical sensors						
		MA95A	MA96E	MA97B	MA98A	MA911A	MA912A/B	MA913E
Wavelength range (μm)		0.38 to 1.15	0.75 to 1.7	0.38 to 1.15	0.75 to 1.8	0.4 to 1.15	0.4 to 1.15	0.75 to 1.7
Measuring range (dBm)		−90 to 0	−90 to 0	−65 to +10	−40 to +10	−60 to +10	−60 to +10	−60 to 0
Input type	Connector	●	●	●*	●*	●*		●
	Beam			●	●	●	●	
Indicator (Main frame)	ML93B	●	●	●	●	●	●	●
	ML94A			● (−60 to +10 dBm)	●	●	●	● (−60 to 0 dBm)
	ML96B			● (−60 to +10 dBm)	●	●	●	● (−60 to 0 dBm)

* When used with MP92A Connector Adaptor (option).

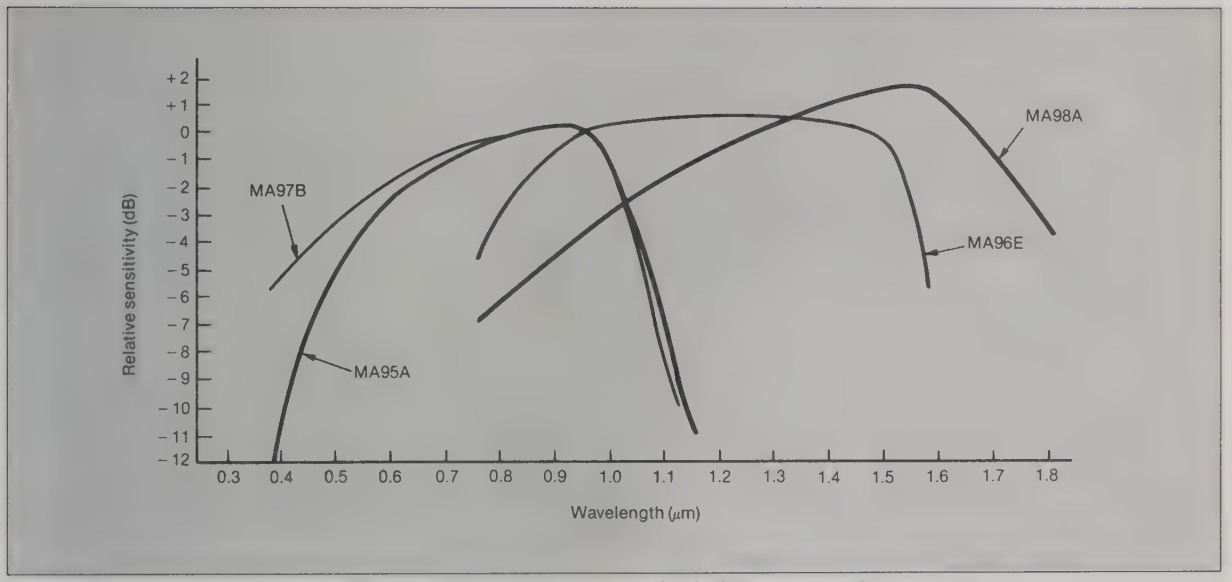
		Optical sensors								
		MA9801A	MA9301A	MA9802A	MA9302A	MA9803A	MA9303A	MA9804A	MA9304A	MA9305A
Wavelength range (μm)		0.38 to 1.15	0.75 to 1.7	0.38 to 1.15	0.75 to 1.8	0.38 to 1.15	0.75 to 1.8	0.38 to 1.15	0.75 to 1.8	0.75 to 1.7
Measuring range (dBm)		−90 to 0	−90 to 0	65 to +20*	−40 to +20*	−65 to +10	−40 to +10	65 to +10	40 to +10	−60 to 0
Input type	Connector	●	●	●**	●**			●	●	●
	Beam			●	●	●	●			
Indicator ML910A		●	●	●	●	●	●	●	●	●

* When used with an optical attenuator (optional accessory).
** A connector adaptor (sold separately) is necessary.

● Optical power sensors for low power levels (MA95A, MA96E)
A style of optical modulation (patent pending) is adopted in which the injected light is derectly modulated so that even low power levels can be stably measured.

● Optical power sensors for high power levels (MA97B, MA98A, MA911A)
With their large apertures for receiving light, these units are suitable for measuring the power levels of light traveling in free space. If an optional adaptor is fit over the aperture, they can measure light in optical fibers or cables through a conventional connector.

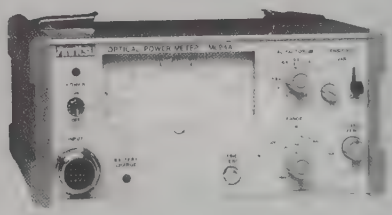
● Miniature optical power sensor (MA912A)
Since the sensor is only 4 mm thick, this unit is convenient for making measurements in restricted or confined areas.



Wavelength sensitivity response (optical power sensors).

Optical Power Meter
ML93B/ML94A

ML93B



ML94A

Features

- 0.001 dB resolution
- All of the optical power sensors can be connected to the display units without adjustments.
- Designed to cover a broad range of wavelengths (0.38 μm to 1.8 μm) with a wide dynamic range from −90 to +10 dBm.
- By inputting a calibration constant for the optical power sensor, compensated values can be read directly from the meter. Data concerning the wavelength sensitivity characteristics of all the optical power sensors is available.
- The zero power level can be calibrated by pushing a single button.
- Battery operation is possible.

Description

The ML93B (digital display) and the ML94A (analog display) are optical power meters. The ML93B can be combined with 7 types and the ML94A with 5 types of optical power sensors to match the customers' applications. No adjustments whatsoever are necessary when connecting the power sensors to the power meters. A broad range of wavelengths (0.38 μm to 1.8 μm) is covered by two optical power sensors. They are specially stable at low power levels and measure all powers with high accuracy.

Accessories include (1) adapters for fibers and connectors that can be easily attached to optical fiber cables, and (2) a convenient holder for the optical power sensor used to measure the level of light traveling through free space. The ML93B is equipped with a GP-IB interface allowing measurements to be automated. The ML94A includes a rechargeable battery so that measurements can also be made in the field. The ML93B can be operated with an optional battery pack.

Options

- MZ95A Battery Pack (for ML93B) (Photo 1)
- MZ96A Battery Charger (for MZ95A) (Photo 2)

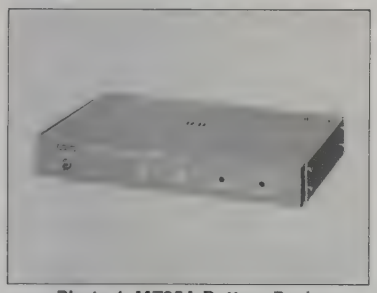


Photo 1 MZ95A Battery Pack

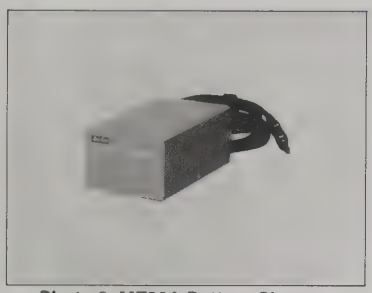
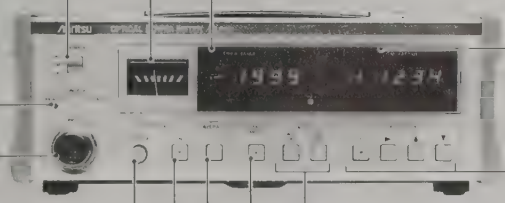


Photo 2 MZ96A Battery Charger



LEVEL METER: For monitoring the input power.

POWER DISPLAY: Displays the measured power level.

POWER SWITCH: Switch to AC for use with AC line and to DC when using the battery.

DISPLAY CONTROL: The REMOTE lamp turns on when remote control is specified. Otherwise, the LOCAL lamp is lit.

CALIBRATION CONSTANT DISPLAY: Displays the value used to compensate for the sensitivity of the optical power sensor.

INPUT CONNECTOR: For connection to the optical power sensor.

CALIBRATION CONSTANT INPUT: Sets the constant used to compensate for the sensitivity of the optical power sensor.

ZERO ADJUSTMENT (COARSE ADJUSTMENT): This knob calibrates the zero level.

MODE SWITCH: If the "dBm W" key is depressed, the power unit will switch alternately between decibels and watts. With the "dB (REL)" key, the relative optical power value (the level difference (dB) between a set reference value and a measured value) can be displayed.

AUTOMATIC ZERO CALIBRATION (FINE ADJUSTMENT): If this key is pushed when absolutely no light is entering the aperture of the optical power sensor, the zero level is automatically calibrated.

AVERAGE: If the average key is depressed, averaging is set or reset alternately.

RANGE/HOLD: Permits selection between the automatic ranging or the fixed range operation (HOLD).

Specifications

● ML93B

Indicator (Main frame)	Display	Selection among Watts/dBm/dB (REL), 4 digits and an analog meter					
	Calibration coefficient	Front panel adjustment					
	Recorder output	Proportional to indicated power with 1V corresponding to full scale and 0.316V to −5 dB, in each range					
	Relative value display	Digital 4 digits					
	Averaging	ON/OFF switchable					
	Dimensions and weight	282W, 99H, 200Dmm, ≦3.5kg					
Sensor	Model	MA95A	MA96E	MA97B	MA98A	MA911A/MA912A/B	MA913E
	Wavelength range	0.38 to 1.15μm	0.75 to 1.7μm	0.38 to 1.15μm	0.75 to 1.8μm	0.4 to 1.15μm	0.75 to 1.7μm
	Element	Si photo diode	InGaAs photo diode	Si photo diode	Ge photo diode	Si photo diode	InGaAs photo diode
	Active area diameter	—	—	D = 9.5mm	D = 5mm	D = 8mm	—
	Input type	Connector		Direct to photo diode			Connector
	Dimensions and weight	65φ, 86L mm, ≦700g		35φ, 27L mm, ≦100g		35φ, 27L mm, ≦100g (MA911A) 16φ, 130L mm, ≦25g (MA912A)	25H, 20W, 30D mm, ≦300g
Overall	Power measuring range	−90 to 0dBm (at 0.85μm)	−90 to 0dBm (at 1.3μm)	−65 to +10dBm (at 0.85μm)	−40 to +10dBm (at 1.3μm)	−60 to +10dBm (MA911A/912A: at 0.85μm) (MA912B: at 0.78 μm)	−60 to 0dBm (at 1.3μm)
	Accuracy	±5% (0.85μm, −10dBm)	±5% (1.3μm, −10dBm)	±5% (0.85μm, −10dBm)	±5% (1.3μm, −10dBm)	±5% (0.85μm, −10dBm)	±5% (1.3μm, −10dBm)
	Resolution	Watts display: 0.1 to 1%, dBm display: 0.001dB					
	Power	100V* ±10%, 50/60Hz, <20VA or Battery Pack MZ95A					
	Ambient temperature, rated range of use	0 to 45°C					

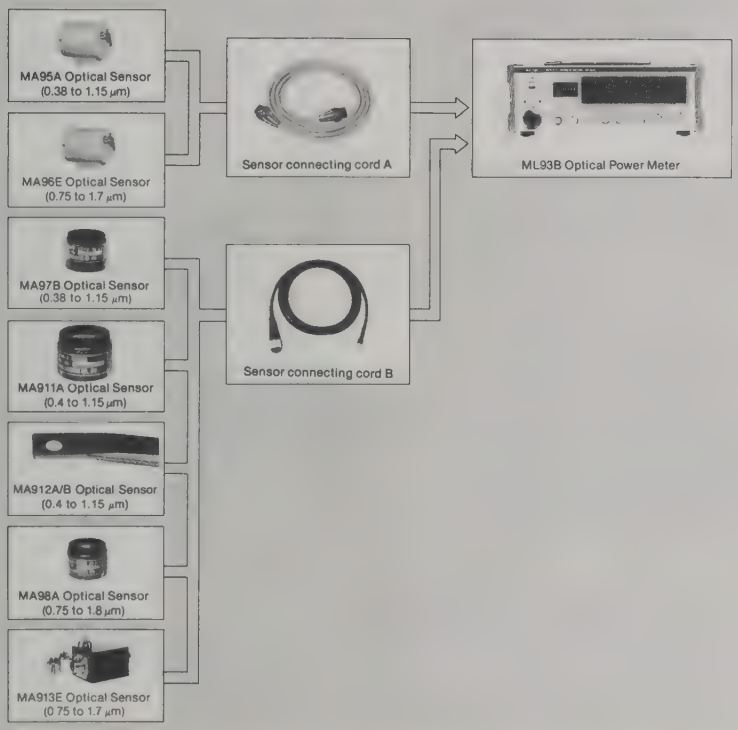
● ML94A

Indicator (Main frame)	Display	Meter display: Watts linear scale and dB scale			
	Calibration coefficient	Setting is possible in 0.05dB steps in the range of 0 to 1dB in calibration value			
	Recorder output	Watts linear output: 1V corresponding to the meter full-scale, in each range			
	Relative value display	Readable from the relative difference in the meter scale. The reference value can be shifted over ±2.5dB on the scale.			
	Averaging	—			
	Dimensions and weight	210W, 99H, 200D mm, ≦2.7kg			
Sensor	Model	MA97B	MA98A	MA911A/MA912A/B	MA913A
	Wavelength range	0.38 to 1.15μm	0.75 to 1.8μm	0.4 to 1.15μm	0.75 to 1.7μm
	Element	Si photo diode	Ge photo diode	Si photo diode	InGaAs photo diode
	Active area diameter	D = 9.5mm	D = 5mm	D = 8mm	—
	Input type	Direct to photo diode			Connector
	Dimensions and weight	35φ, 27L mm, ≦100g		35φ, 27L mm, ≦100g (MA911A) 16φ, 130L mm, ≦25g (MA912A/B)	25H, 20W, 30D mm, ≦300g
Overall	Power measuring range	−60dBm to +10dBm (at 0.85μm)	−40dBm to +10dBm (at 1.3μm)	−60dBm to +10dBm (MA911A/912A: at 0.85μm) (MA912B: at 0.78μm)	−60dBm to 0dBm (at 1.3μm)
	Accuracy	±5% (0.85μm, −10dBm)	±5% (1.3μm, −10dBm)	±5% (MA911A/MA912A: at 0.85μm, −10dBm) (MA912B; at 0.78μm, −10dBm)	±5% (1.3μm, −10dBm)
	Resolution	2%			
	Power	100V, 50/60Hz, ≦3VA or internal rechargeable battery			
	Ambient temperature, rated range of use	0 to 45°C			

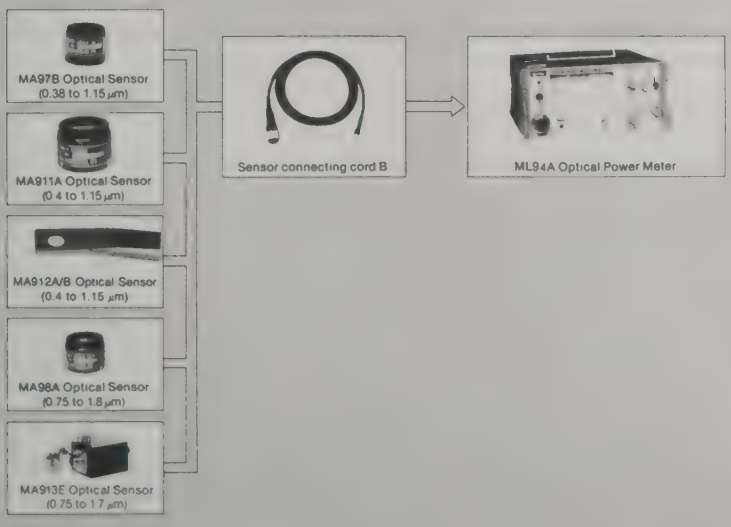
Note: The optical connector of the standard product is FC.
Consult us should you need modification of the optical connector.
* Specify one nominal AC line voltage between 100V and 250V when ordering.

Combinations of Optical Power Meters and Sensors

ML93B with sensors



ML94A with sensors

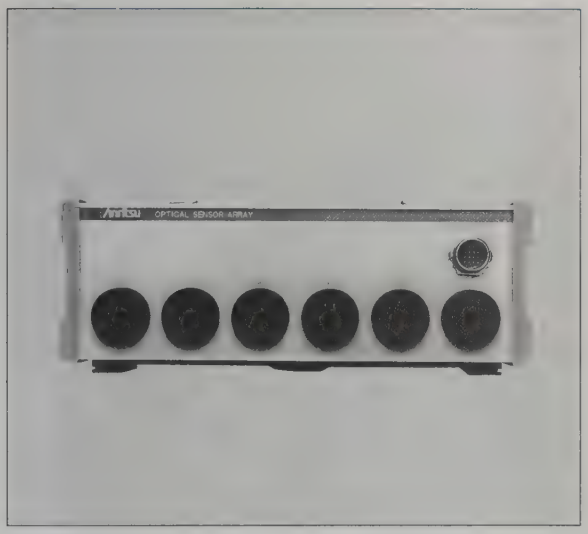


Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
ML93B	Optical Power Meter		
ML94A	Optical Power Meter		
	Standard accessories		
J0089	Sensor connecting cord A, 2 m:	1 pc	Supplied with ML93B. For MA95A/MA96E
J0214	Sensor connecting cord B, 2 m:	1 pc	Supplied with ML93B or ML94A. For MA97B, MA98A, MA911A, MA912A/B and MA913E.
	Fuse for ML93B/ML94A, 0.5 A:	1 pc	MF51NN250V0.5AAC05
	Fuse for ML93B, 2A:	1 pc	MF51NN250V2ADC05
	ML93B Operation manual:	1 copy	Supplied with each model
	ML94A Operation manual:	1 copy	
	Optical sensors, applicable for both the ML93B and the ML94A		
MA97B	Optical Sensor		0.38 to 1.15 μm, −65 to +10 dBm
MA98A	Optical Sensor		0.75 to 1.8 μm, −40 to +10 dBm
MA911A	Optical Sensor		0.4 to 1.15 μm, −60 to +10 dBm
MA912A/B	Optical Sensor		0.4 to 1.15 μm, −60 to +10 dBm
MA913A	Optical Sensor		0.75 to 1.7 μm, −60 to 0 dBm
	Optical sensor applicable for the ML93B		
MA95A	Optical Sensor		0.38 to 1.15 μm, −90 to 0 dBm
MA96E	Optical Sensor		0.75 to 1.7 μm, −90 to 0 dBm
	Optional accessories, applicable to both the ML93B and the ML94A		
MP92A	Connector Adaptor		For MA97B, MA98A and MA911A
MP93A	Fiber Adaptor		≧150 μm clad dia., 0.8 to 1.0 mm jacket dia.
MP915A	Fiber Adaptor		125 μm clad dia., 0.25 to 1.0 mm jacket dia.
MP916A	Fiber Adaptor		For plastic fiber, 1 to 5 mm dia.
MP94A	Adaptor		Used in conjunction with MP93A
MZ107A	Sensor Holder		
	Optional accessories, applicable to the ML93B		
MZ95A	Battery Pack		Rechargeable. Operates continuously for 8 hours
MZ96A	Battery Charger		
J0008	GP-IB cable, 2 m		
B0009	Front cover		
B0110	Rack mount Kit		JIS type
B0111	Rack mount Kit		Inch type

Sensor Array
MZ130A/MZ147B



Features

- Up to six inputs can be handled, facilitating measurement of optical power loss in a multicore optical fiber cable.
- This sensor array operates as if the MA97B sensor was directly connected to the indicator, resulting in high accurate measurement.

Applications

Combined with the Optical Power Meter ML93B and Channel Selector MZ129A, the Sensor Array MZ130A and MZ147B are used to measure optical power loss and splicing loss in a multicore optical fiber cable.

Front panel

Optical detector
(MA97B, 0.38 to 1.15 μm)
(MA913E, 0.75 to 1.7 μm)

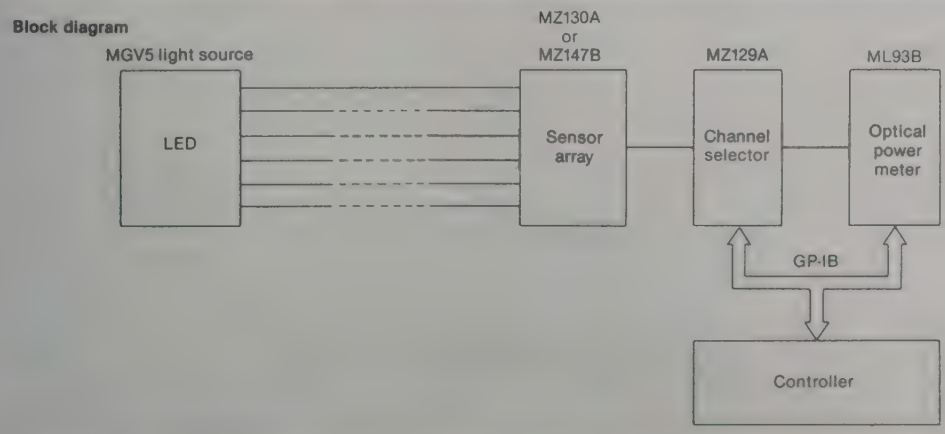
Specifications

	MZ130A	MZ147B
Wavelength range	0.38 to 1.15 μm	0.75 to 1.7 μm
Optical power measurement range	−65 to +10 dBm (at 0.85 μm)	−60 to 0 dBm (at 1.3 μm)
Measurement accuracy	±5% (0.85 μm, −10 dBm)	±5% (1.3 μm, −10 dBm)
Number of channels	6	6
Dimensions and weight	99H, 282W, 200Dmm, ≦2.5 kg	99H, 282W, 200Dmm, ≦2.5 kg

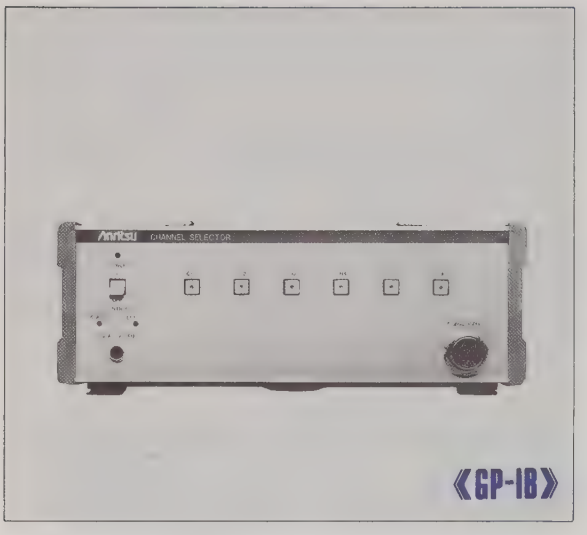
Applications

For testing stability of multicore optical fiber cables.

Block diagram



Channel Selector
MZ129A



Features

- As many as six optical power inputs can be handled to facilitate measurement of optical loss in a multicore optical fiber cable.
- Can be externally controlled via GP-IB.

Applications

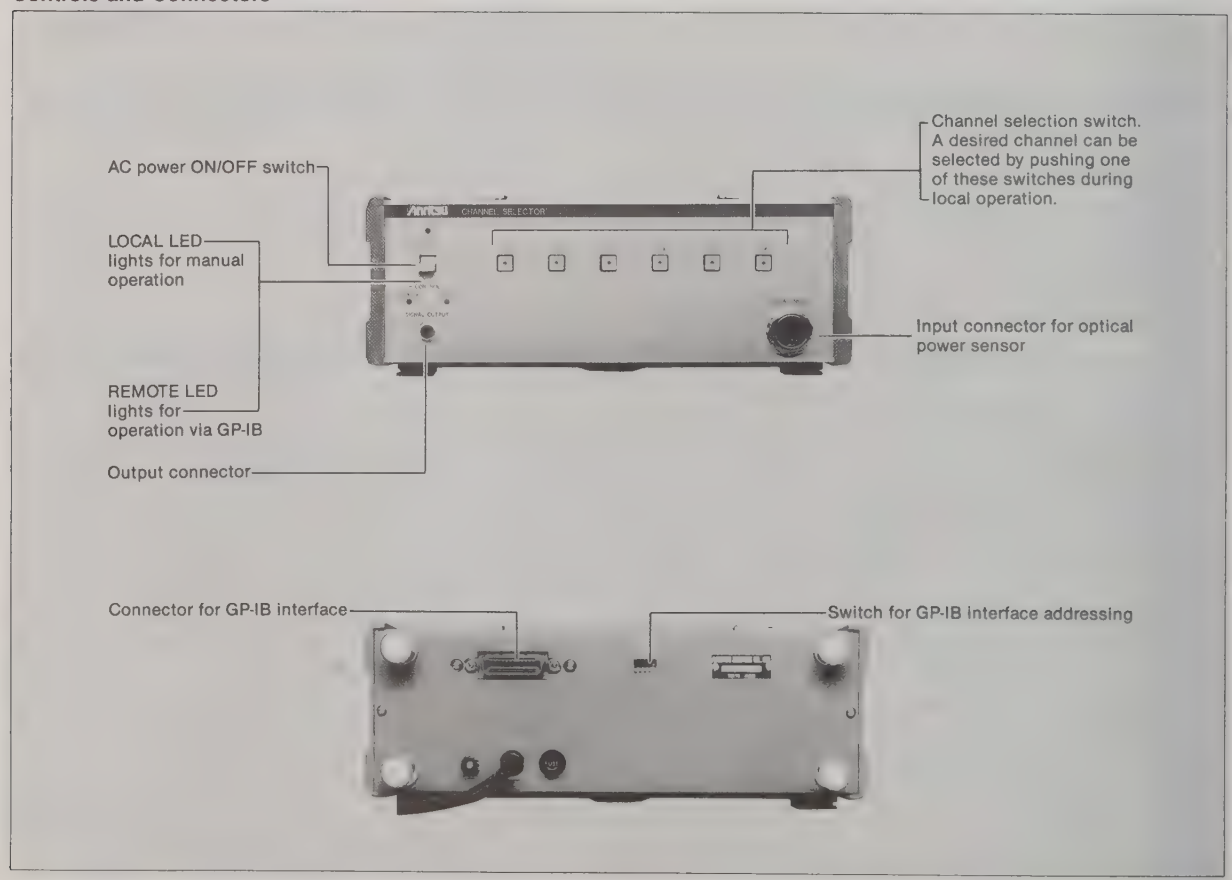
Combined with the Optical Power Meter ML93A and Sensor Array MZ130A, this channel selector is used to measure optical loss in multicore optical fiber cable and connections.

Specifications

Number of channels	6
Power	AC **V, 50/60Hz

**Specify one nominal line voltage between 100V and 250V when ordering.

Controls and Connectors


AC power ON/OFF switch
LOCAL LED lights for manual operation
REMOTE LED lights for operation via GP-IB
Output connector
Channel selection switch. A desired channel can be selected by pushing one of these switches during local operation.
Input connector for optical power sensor
Connector for GP-IB interface
Switch for GP-IB interface addressing

Optical Handy Power Meter
ML96B

Description

ML96B is hand-held optical power meter. Operated by battery it can be conveniently carried anywhere. A thin sensor enables measurement to be taken in a confined area.
And optical power sensors can be directly connected to an indicator. From research and development to maintenance of optical communications, videodisks and digital audio equipment, ML96B will prove to be indispensable as a handy optical power measuring equipment.

Features

- Simple to operate with only two buttons and one dial.
- Easy-to-use automatic ranging.
- A mere push on the button switches the indicator from W(watts) to dBm.
- Relative value indication with single touch.
- Automatic display check system equipped.
- Runs for up to 20 hours on a battery.
- A battery alarm built in.
- Comes with a battery charger.

Specifications

Sensor	Display	W, dBm, dB (Relative)						
	Number of figures	4 digits (dBm, dB) 3-1/2 digits (W)						
	Dimensions and weight	150H, 85W, 28Dmm, ≦0.3kg						
	Accessories supplied	One sensor connecting cord, one battery charger						
Indicator	Model	MA97B	MA911A	MA912A/B	MA916A	MA913E	MA98A	MA917E
	Wavelength	0.38 to 1.15μm	0.4 to 1.15μm			0.75 to 1.7μm	0.8 to 1.8μm	0.75 to 1.7μm
	Element	Si photo diode				InGaAs photo diode	Ge photo diode	InGaAs photo diode
	Active area diameter	D = 9.5mm	D = 8mm		—	—	D = 5mm	—
	Input type	Photo diode			Connector*1	Connector*1	Photo diode	Connector*1
	Indicator connection	Connecting cord C			Directly or via cord D	Connecting cord C	Connecting cord C	Directly or via cord D
	Dimensions and weight	35φ, 27Lmm, <100g		16φ, 130Lmm <25g	27φ, 30Lmm <100g	25H, 20W, 30Dmm, <300g	35φ, 27Lmm, <100g	27φ, 30Lmm, <100g
Overall	Measuring range	−60 to +10dBm (at 0.85μm)	−60 to +10 dBm (MA911A/MA912A/MA916A: at 0.85μm) (MA912B: at 0.78μm)			−60 to 0dBm (at 1.3μm)	−40 to +10dBm (at 1.3μm)	−60 to 0dBm (at 1.3μm)
	Accuracy	±5% (at 0.85μm −10dBm)	±5% (MA911A/912A/916A; at 0.85μm, −10dBm) (MA912B: at 0.78μm, −10dBm)			±5% (at 1.3μm, −10dBm)	±5% (at 1.3μm, −10dBm)	±5% (at 1.3μm, −10dBm)*2
	Resolution	0.1 to 1% (Watts), 0.01dB (dBm)						
	Battery life	Operates for about 20 hours, (on internal Ni-Cd battery)						
	Ambient temperature, rated range of use	0 to 45°C						

*1 The standard optical connector is the FC Type.
Please consult us if other types of connectors are desired.
*2 Directly connected to indicator.

RECHARGER CONNECTOR
For the connection to the battery charger.

INPUT CONNECTOR
For the connection to the optical sensor.

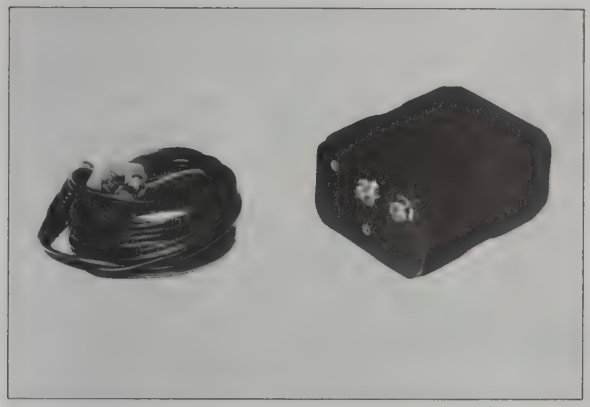
dB (REL) INDICATION
Indicating relative value to the value when button is pushed.

ZERO SET
Temperature delicately affects the reading. Setting the meter at zero prior to measuring ensures accurate reading.

W/dBm SWITCH
Mode can be switched over mutually W to dBm with a single touch.

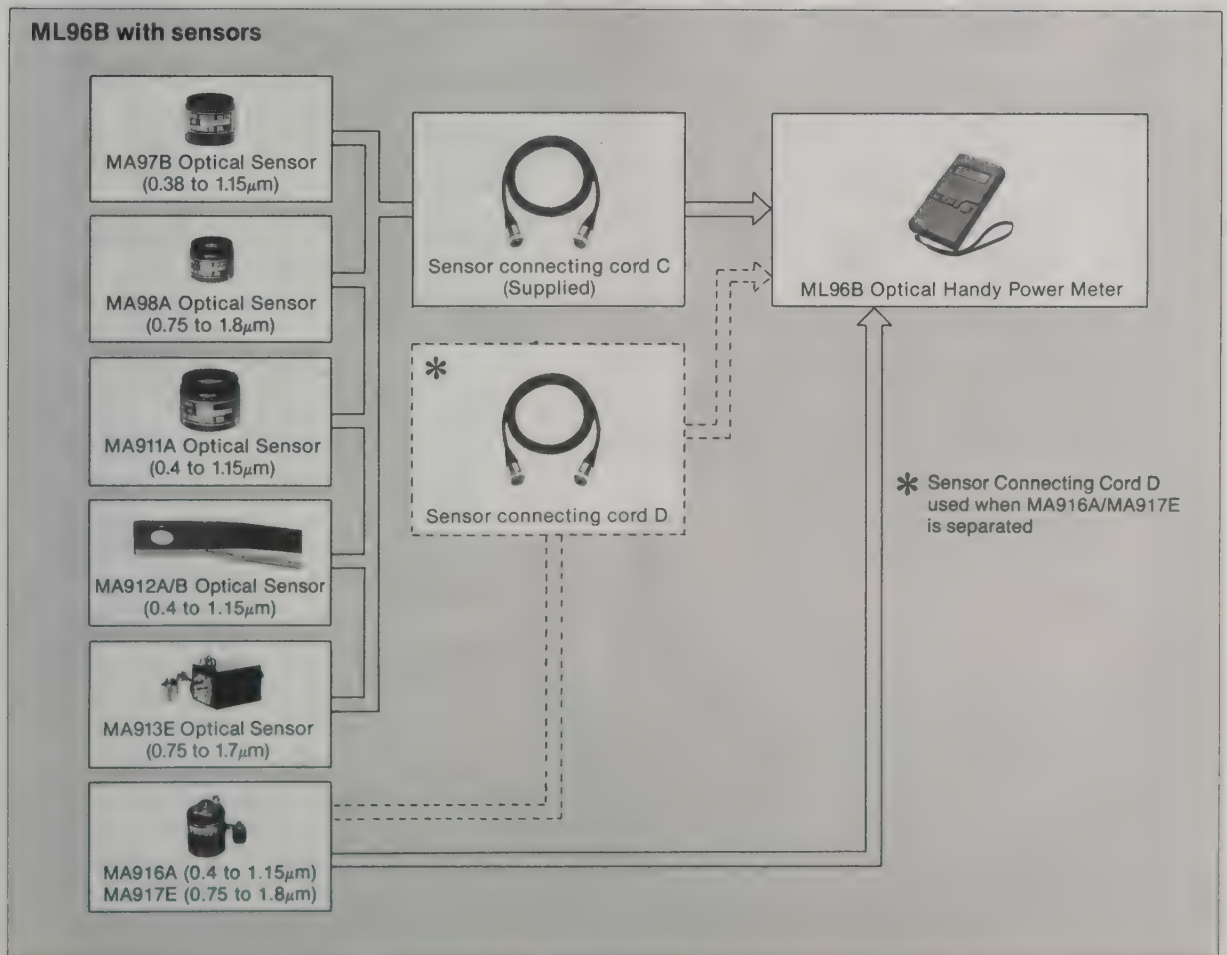
Accessories

- Battery case (Option)
  The battery case (six SUM-3) uses dry cells to power the ML96B.



- Carrying case (Option)
  Holds the main unit, optical power sensors (7 types), adaptors, and the battery case.

ML96B with sensors



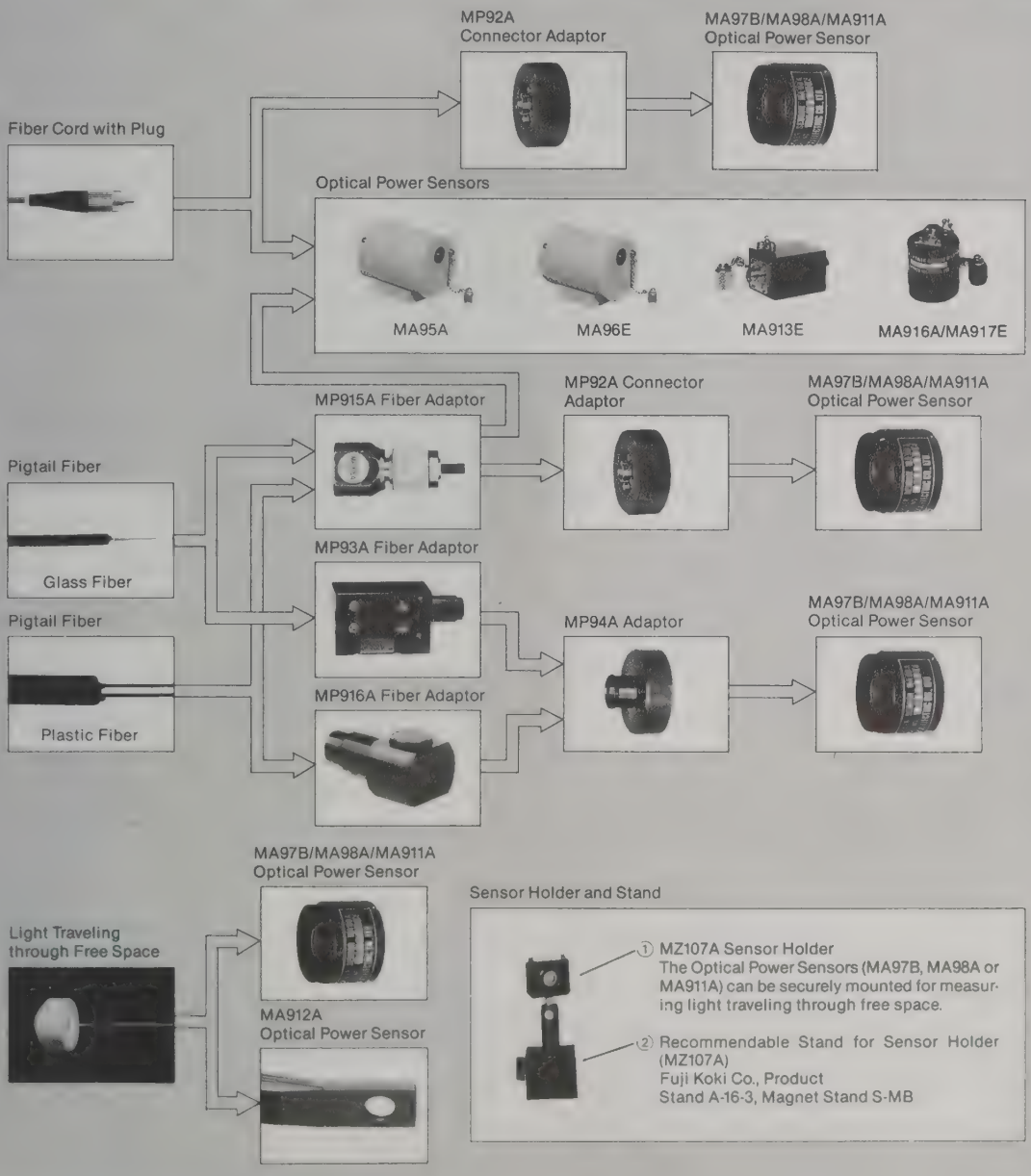
Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
ML96B	Optical Handy Power Meter		
	Standard accessories		
J0212	Sensor connecting cord C, 2 m:	1 pc	For MA97B, MA98A, MA911A, MA912A/B and MA913E
	ML96B Operation manual:	1 copy	
	Optical sensors		
MA97B	Optical Sensor		0.38 to 1.15 μm, −60 to +10 dBm
MA98A	Optical Sensor		0.75 to 1.8 μm, −40 to +10 dBm
MA911A	Optical Sensor		0.4 to 1.15 μm, −60 to +10 dBm
MA912A	Optical Sensor		0.4 to 1.15 μm −60 to +10 dBm
MA913E	Optical Sensor		0.75 to 1.7 μm, −60 to 0 dBm
MA916A	Optical Sensor		0.4 to 1.15 μm, −60 to +10 dBm
MA917E	Optical Sensor		0.75 to 1.7 μm, −60 to 0 dBm
	Optional accessories		
MP92B	Connector Adaptor		For MA97B, MA98A and MA911A
MP93A	Fiber Adaptor		≧150 μm clad dia., 0.8 to 1.0 mm jacket dia.
MP915A	Fiber Adaptor		125 μm clad dia., 0.25 to 1.0 mm jacket dia.
MP916A	Fiber Adaptor		For plastic fiber with 1 to 5 mm dia.
MP94A	Adaptor		Used in conjunction with MP93A
MZ107A	Sensor Holder		
J0213	Sensor connecting cord D, 2 m:		For MA916A and MA917E
B0133	Battery Case		For six UM-3 dry cells
B0096	Carrying case		Holds one indicator, five sensors, one adaptor and one battery box.

Adaptors for Optical Power Meter

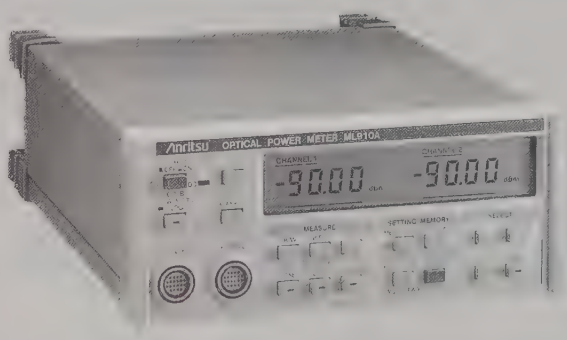
Adaptors (Option)



MP915A FIBER ADAPTOR: Pigtail fiber can be joined to FC connectors. (Standard fibers for use with this device have a cladding diameter of 125 μm and a jacket diameter between 0.25 mm and 1.0 mm.)
MP93A/MP916A FIBER ADAPTOR: In combination with MP94A adaptor, pigtail fiber can be joined to the Optical Power Sensor (MA97B, MA98A, or MA911A).
(Standard fibers for use with this device have a cladding diameter below 150 μm and a jacket diameter between 0.8 mm and 1.0 mm.)
Note: Before using non-standard fibers (Plastic fibers, etc.) with the MP915A or the MP93A, please consult Anritsu.

Optical Power Meter
ML910A

Traceable to the NBC and ETL standards



《GP-IB》

Features

- Two input channels with simultaneous data display.
- Data processing between channels.
- Relative measurements with a resolution of 0.001 dB.
- Feed through sensor permits highly stable optical-loss measurements.
- −90 dBm measurement sensitivity at 1.3 μm.
- Wavelength selection function enables direct readout of absolute optical power.
- Data storage of up to 3,000 measurements.
- Relative data recall allows a full range of relative functions.
- Internal display calibration boosts reliability.
- Auxiliary analog display using bar graph.

Description

The ML910A optical power meter provides two independent channels and advanced functions, enabling a variety of sophisticated optical-power measurements. Nine types of optical detectors are available to suit a variety of applications—any two can be connected as required.

The two channels are completely independent, and have separate displays, providing the same versatility that previously required two meters. Processing between channels is also possible. If a feed through sensor is used, fluctuations in the output level of the optical source can be canceled, enabling exceptionally precise relative measurements with a resolution down to 0.001 dB.

Wavelengths from 0.38 to 1.8 μm can be measured, with sensitivity down to −90 dBm at 1.3 μm. The optical detectors have a built-in wavelength responsivity, so direct readout of the absolute optical power is possible simply by specifying the wavelength of compensation. A simple change in connections permits uncompensated measurements as well.

The data-storage function of the ML910A enables up to 3,000 measured values to be stored at the touch of a button, which greatly simplifies work in the field. An internal display calibration circuit is also provided, boosting overall reliability.

NBS: National Bureau of Standards U.S.A.
ETL: Electrotechnical Laboratory Japan

Specifications

Indicator (Main frame)	Display	Selection among watts/dBm/dB (REL), 4-digit digital display of two signals, bar graph								
	Calibration coefficient	Front-panel adjustment								
	Recorder output	Proportional to indicated power with 1V corresponding to full scale, and 0.316 V to −5 dB, in each range								
	Relative value display	Digital 4 digits								
	Averaging	ON/OFF switchable								
	Dimensions and weight	88 H, 213 W, 250 D mm. ≦3.0 kg								
	Accessories	Sensor connecting cord A and B (one each)								
Sensor	Model	MA9801A	MA9301A	MA9802A	MA9302A	MA9803A Feed through sensor	MA9303A Feed through sensor	MA9804A Feed through sensor	MA9304A Feed through sensor	MA9305A
	Wavelength range	0.38 to 1.15 μm	0.75 to 1.7 μm	0.38 to 1.15 μm	0.75 to 1.8 μm	0.38 to 1.15 μm	0.75 to 1.8 μm	0.38 to 1.15 μm	0.75 to 1.8 μm	0.75 to 1.7 μm
	Element	Si photodiode	InGaAs photodiode	Si photodiode	Ge photodiode	Si photodiode	Ge photodiode	Si photodiode	Ge photodiode	InGaAs photodiode
	Active area diameter	—	—	D=9.5 mm	D=5 mm	(Note 1)	(Note 1)	—	—	—
	Insertion loss	—	—	—	—	≦6 dB	≦6 dB	≦10 dB	≦10 dB	—
	Input type	Connector (Note 2)		Director to photodiode		Director to photodiode		Connector (Note 2)		Connector (Note 2)
	Dimensions and weight	42H, 61W, 110D mm, ≦0.7 kg		31H, 40W, 62D mm, ≦0.4 kg		44H, 25W, 70D mm, ≦0.3 kg		62H, 55W, 49D mm, ≦0.4 kg		31H, 40W, 62D mm, ≦0.4 kg
Overall	Power measuring range	−90 to 0 dBm (at 0.85 μm) 1 pW to 1 mW	−90 to 0 dBm (at 1.3 μm) 1 pW to 1 mW	−65 to +20 dBm* (at 0.85 μm) 0.3 nW to 0.1 W	−40 to +20 dBm* (at 1.3 μm) 100 nW to 0.1 W	−65 to +10 dBm (at 0.85 μm) 0.3 nW to 10 mW	−40 to +10 dBm (at 1.3 μm) 100 nW to 10 mW	−65 to +10 dBm (at 0.85 μm) 0.3 nW to 10 mW	−40 to +10 dBm (at 1.3 μm) 100 nW to 10 mW	−60 to 0 dBm (at 1.3 μm) 1 nW to 1 mW
	Accuracy	±5% (0.85 μm, −23 dBm)	±5% (1.3 μm, −23 dBm)	±5% (0.85 μm, −23 dBm)	±5% (1.3 μm, −23 dBm)	—	—	—	—	±5% (1.3 μm, −23 dBm)
	Resolution	Watts display: 0.1 to 1%. dBm display: 0.01 dB. dB (REL) DIFF display: 0.001 dB								
	Ambient temperature, rated range of use	0 to 45°C								
	Power	AC 100 V, 50/60 Hz, ≦ 20 VA, DC 10.5 to 15 V external power source								

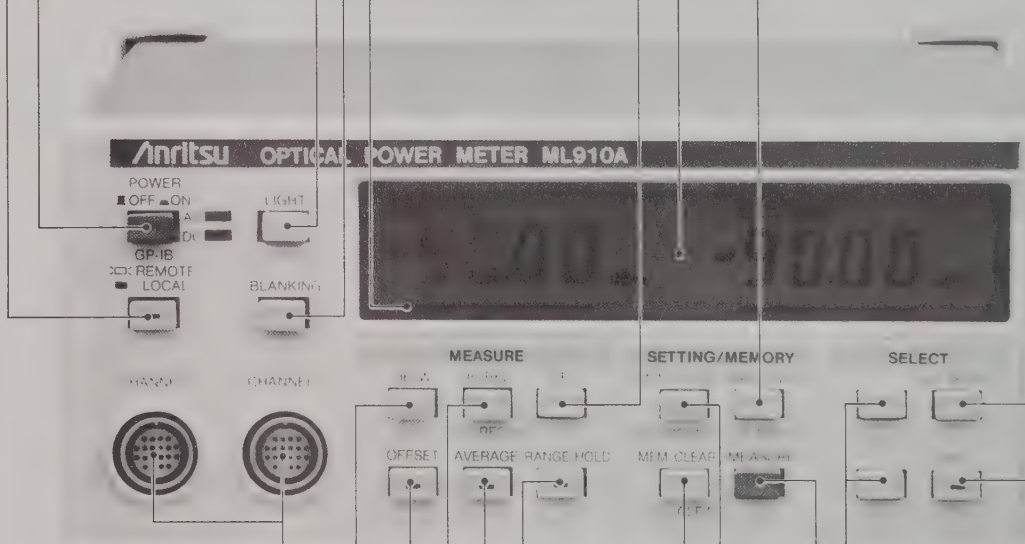
Notes: 1 Beam diameter having <1.7ϕ must be used.
2 The optical connector of the standard product is FC.
Consult us should you need modification of the optical connector.
Note *When used in conjunction with an optical attenuator MA9805A/9306A (sold separately).

Optical Power Measuring Range

Indicator	Optical Sensor	Wavelength (μm)	Optical Power Measuring Range [dBm] −90 −80 −70 −60 −50 −40 −30 −20 −10 0 +10 +20
ML910A	MA9801A	0.38 to 1.15	
	MA9802A	0.38 to 1.15	
	MA9301A	0.75 to 1.7	
	MA9305A	0.75 to 1.7	
	MA9302A	0.75 to 1.8	

Note ⊢---⊣ : When used in conjunction with an optical attenuator (MA9805A/9306A).

ML910A Front Panel



LIGHT SWITCH: Toggles LCD backlighting.

LOCAL SWITCH: Releases remote control

POWER SWITCH: Toggles power on and off.

BLANKING SWITCH: Used when the least significant digit display is unnecessary

BAR GRAPH: For monitoring.

DIFF SWITCH: Level difference and (dB) between CH 1. CH 2 is displayed on CH 1.

POWER DISPLAY: Shows value and unit of measurement.

WAVELENGTH SWITCH: Sets wavelength.

CAL FACTOR: For inputting correction value.

INPUT CONNECTOR: For connecting optical detector.

dBm/W CHANGEOVER: Switches between display in dBm and watts.

OFFSET SWITCH: Allows automatic offset adjustment of zero point.

dB (REL) SWITCH: When dB (REL) key is pushed, reference value is established. Display is then of difference between reference and measured values.

REL RECALL: Recalls reference for 0 dB (REL).

AVERAGE SWITCH: Averages

RANGE HOLD SWITCH: Fixes measuring range.

MEASURE SWITCH: Changes SETTING/MEMORY mode to MEASURE.

MEM STORE SWITCH: Memorizes data (in dBm).

MEM RECALL: For checking data contained in memory.

MEM CLEAR SWITCH: Erases newest data.

MEM ALL CLEAR: All data is cleared.

SHIFT SWITCH: Changes modes of:
MEM RECALL
CAL FACTOR
REL RECALL
ALL CLEAR
(BLUE LETTERS)
Active only when switch lamp is illuminated.

CHANNEL CHANGE-OVER SWITCH: Select CH 1, CH 2 or both CH 1, 2.

SETTING SWITCH: Sets calibration factor and wavelength.

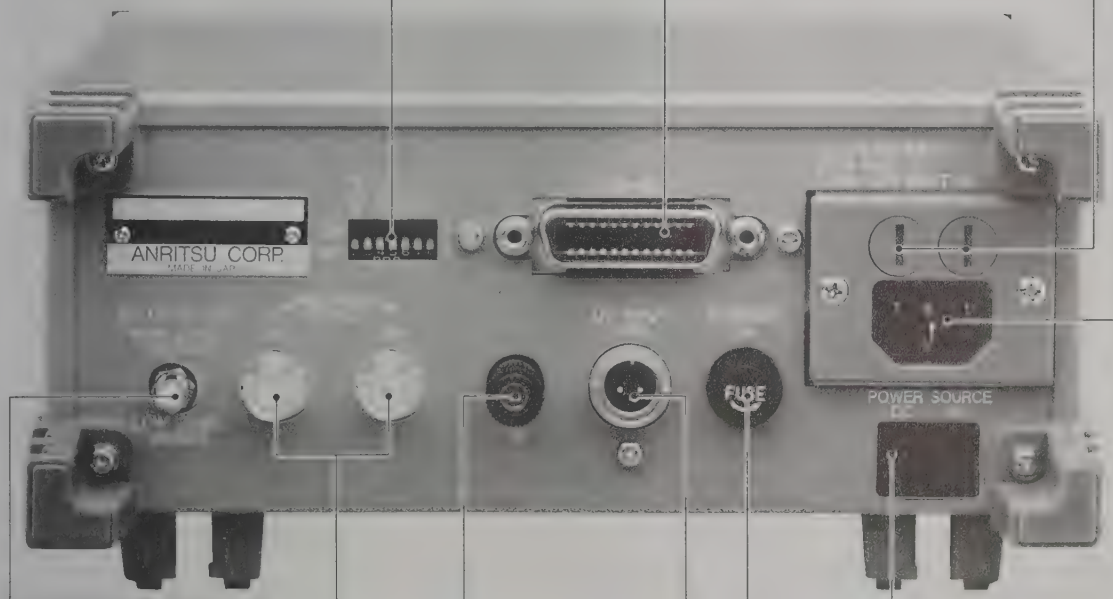
ML910A Rear Panel

ADDRESS SWITCH: Sets address for GP-IB interface; also establishes ETE talk only mode.

GP-IB CONNECTOR: GP-IB interface connector.

AC POWER SOURCE: AC power terminal for connection to commercial line.

FUSE: Fuse for AC power source.



DC LEVEL CAL: Used for calibration of the optical power indication.

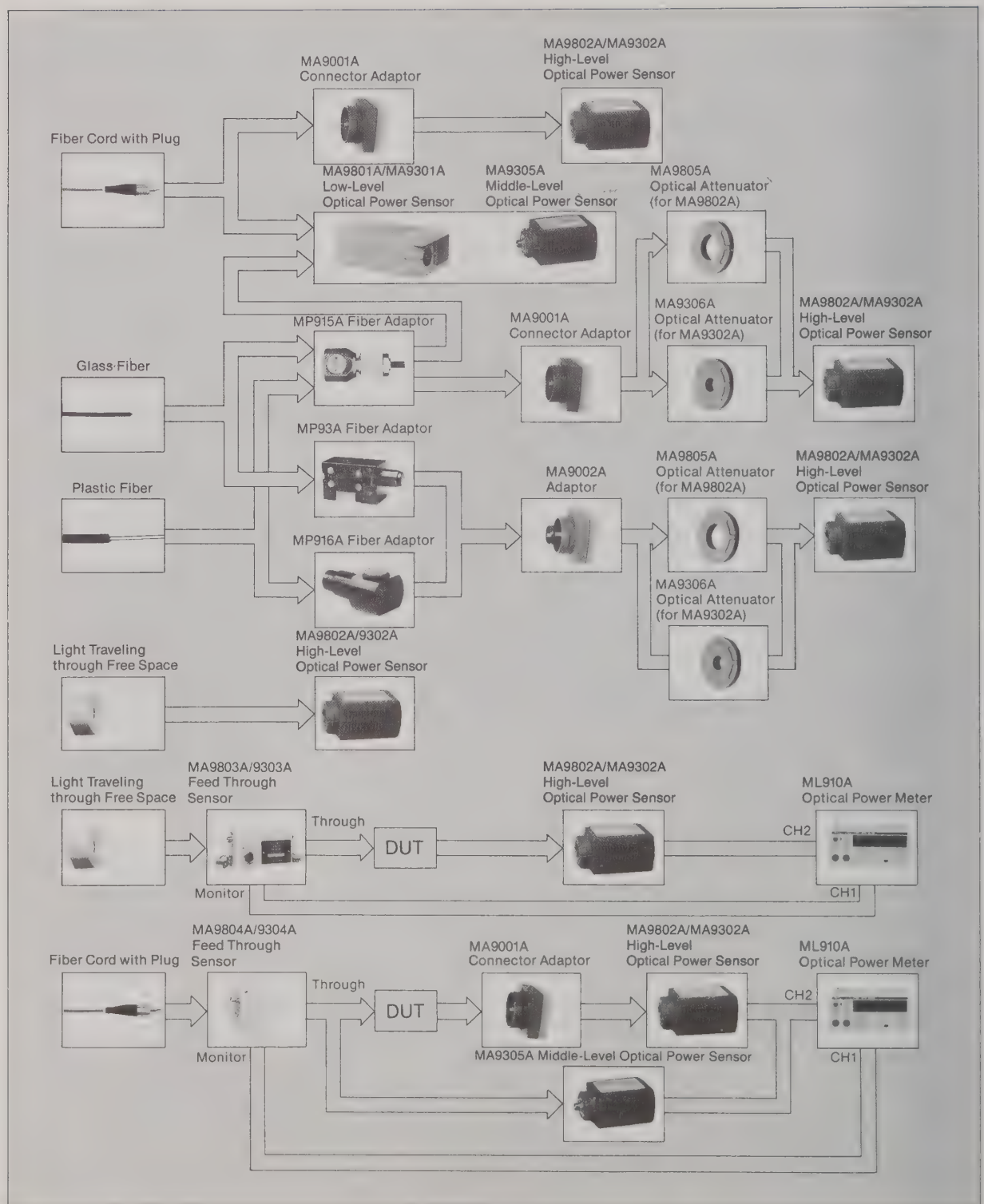
AC/DC CHANGEOVER SWITCH: Change equipment for AC or DC power source.

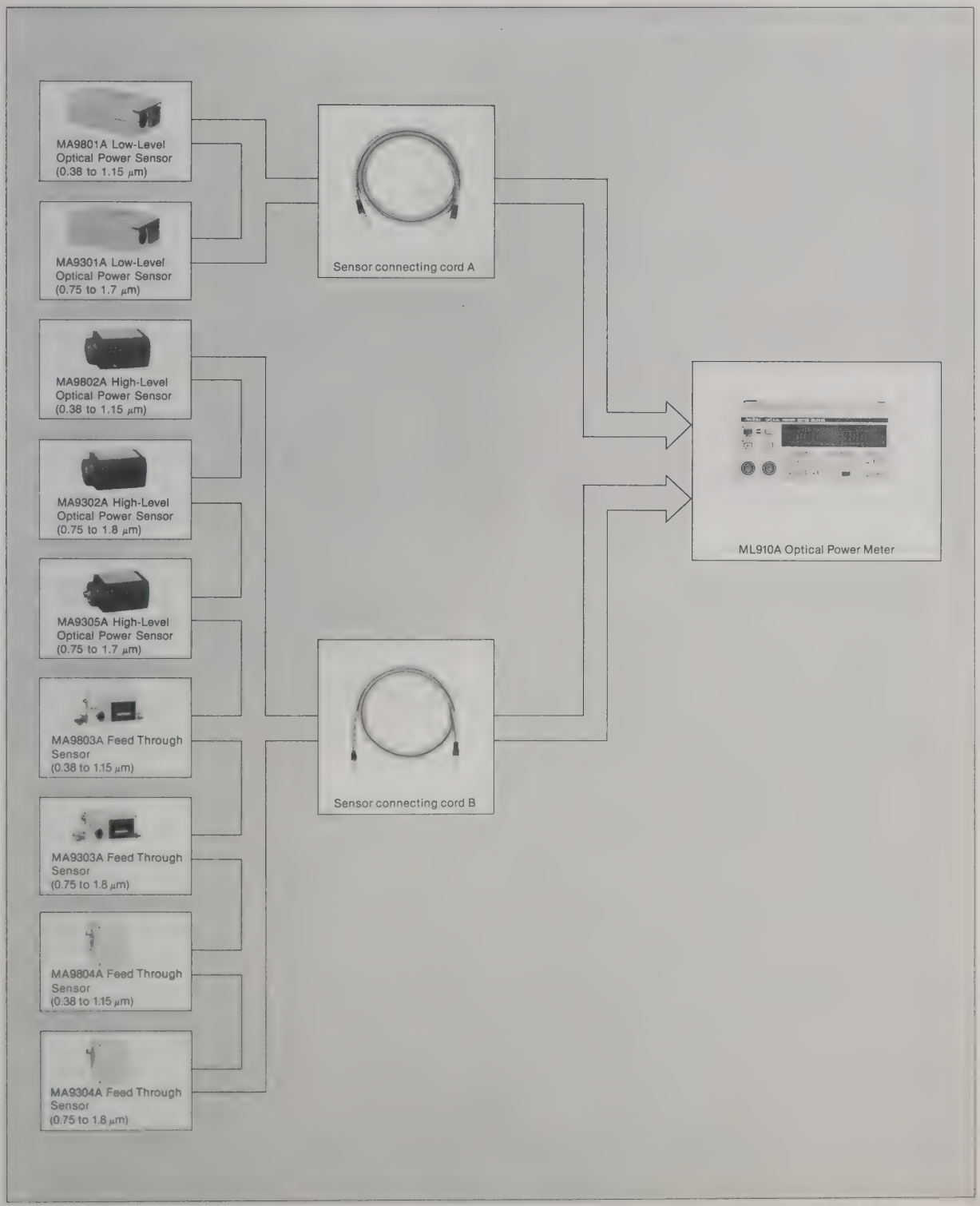
RECORDER OUTPUT: 1V full-scale linear analog output proportional to power level in watts.

FUSE: Fuse for DC power source.

EARTH TERMINAL: Grounds equipment for measurement.

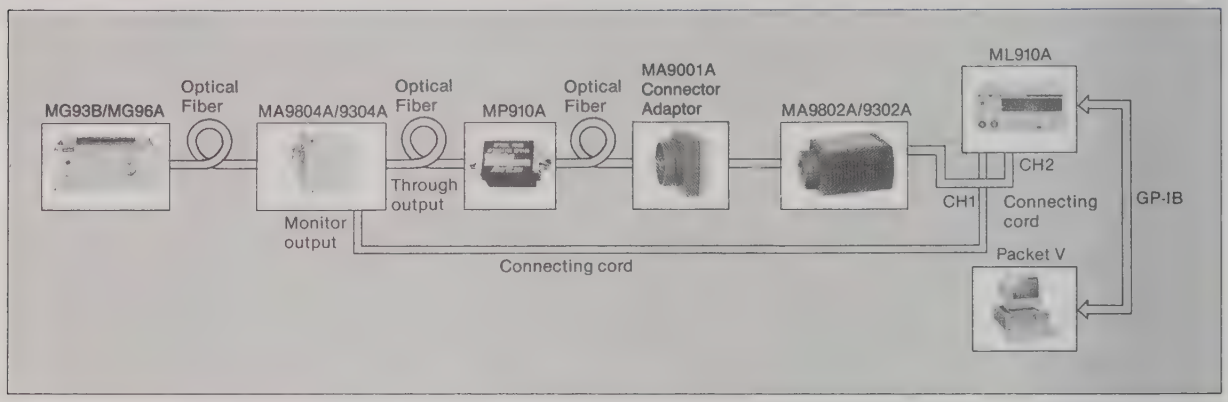
DC POWER INPUT: With special cord, allows operation on DC power source (+10.5 to +15 V)


MA9001A
Connector Adaptor
MA9802A/MA9302A
High-Level
Optical Power Sensor
Fiber Cord with Plug
MA9801A/MA9301A
Low-Level
Optical Power Sensor
MA9305A
Middle-Level
Optical Power Sensor
MA9805A
Optical Attenuator
(for MA9802A)
MA9306A
Optical Attenuator
(for MA9302A)
MA9802A/MA9302A
High-Level
Optical Power Sensor
MP915A Fiber Adaptor
MA9001A
Connector Adaptor
Glass Fiber
MP93A Fiber Adaptor
MA9805A
Optical Attenuator
(for MA9802A)
MA9802A/MA9302A
High-Level
Optical Power Sensor
MA9002A
Adaptor
Plastic Fiber
MP916A Fiber Adaptor
MA9306A
Optical Attenuator
(for MA9302A)
MA9802A/9302A
High-Level
Optical Power Sensor
Light Traveling
through Free Space
Light Traveling
through Free Space
MA9803A/9303A
Feed Through
Sensor
Through
DUT
MA9802A/MA9302A
High-Level
Optical Power Sensor
ML910A
Optical Power Meter
CH2
Monitor
CH1
MA9804A/9304A
Feed Through
Sensor
Fiber Cord with Plug
Through
DUT
MA9001A
Connector Adaptor
MA9802A/MA9302A
High-Level
Optical Power Sensor
ML910A
Optical Power Meter
CH2
Monitor
MA9305A Middle-Level Optical Power Sensor
CH1


MA9801A Low-Level Optical Power Sensor (0.38 to 1.15 μm)
MA9301A Low-Level Optical Power Sensor (0.75 to 1.7 μm)
MA9802A High-Level Optical Power Sensor (0.38 to 1.15 μm)
MA9302A High-Level Optical Power Sensor (0.75 to 1.8 μm)
MA9305A High-Level Optical Power Sensor (0.75 to 1.7 μm)
MA9803A Feed Through Sensor (0.38 to 1.15 μm)
MA9303A Feed Through Sensor (0.75 to 1.8 μm)
MA9804A Feed Through Sensor (0.38 to 1.15 μm)
MA9304A Feed Through Sensor (0.75 to 1.8 μm)
Sensor connecting cord A
Sensor connecting cord B
ML910A Optical Power Meter

Application examples

● Super-high-stability optical loss measuring system setup



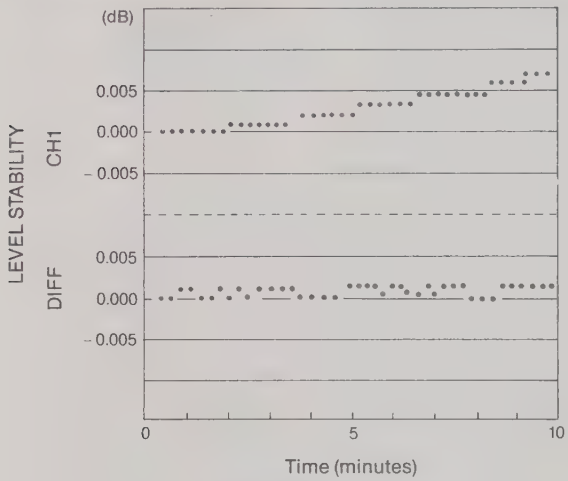
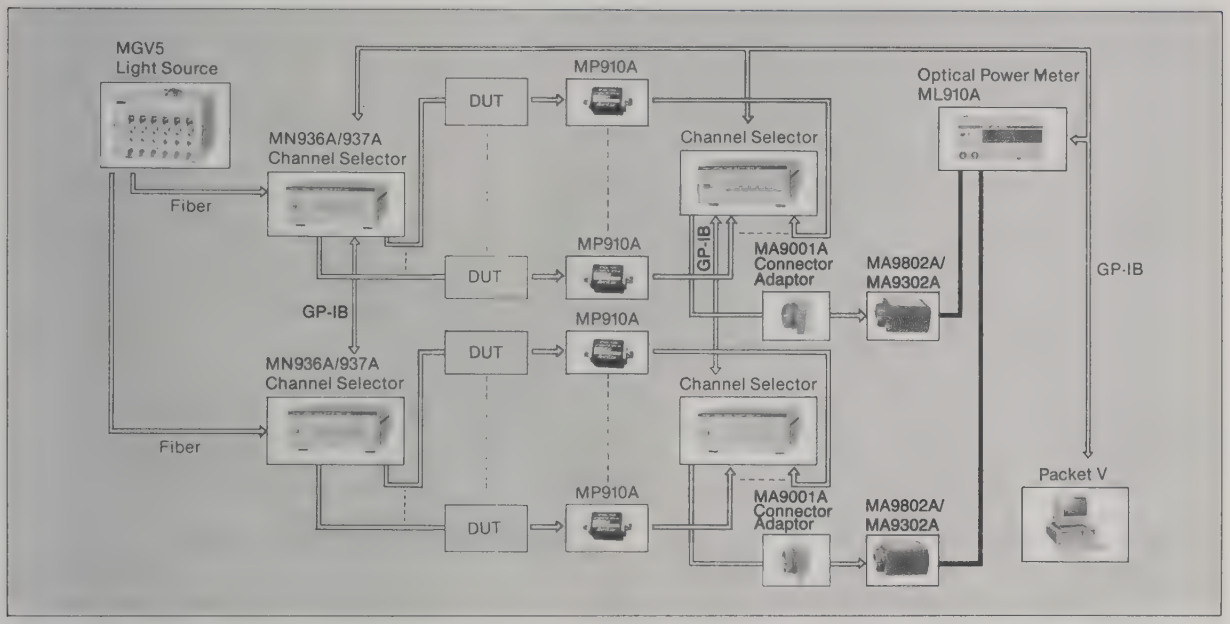


Fig. 1 Level stability (typical data)

Super-high-sensitivity optical loss measuring system

Even stable light sources such as LEDs are subject to fluctuations in output level (0.02 dB per minute in the case of the LEDs used by Anritsu) that limit the accuracy of optical loss measurements to about 0.05 dB. The feedthrough sensor configuration shown here has been developed to cancel the effect of these fluctuations. The ML910A, set to the DIFF mode, displays the difference between reference and tests values (CH1—CH2), realizing measurement resolution of 0.001 dB. By connecting the ML910A to the PACKET V personal technical computer, these measurements can be performed automatically. The graph on the left, produced by this automated configuration, shows typical measurement results.

● **Optical loss measuring system for optical devices**



Configuration of optical power measuring system using multichannel selectors

The configuration shown here permits the optical power or optical loss of multiple devices to be measured simultaneously. The two independent channels and interchannel data processing functions of the ML910A let you configure simple, powerful and compact multichannel systems, whose functions can be automated by adding a personal computer.

Ordering information

Please specify mode/order number, name and quantity when ordering.

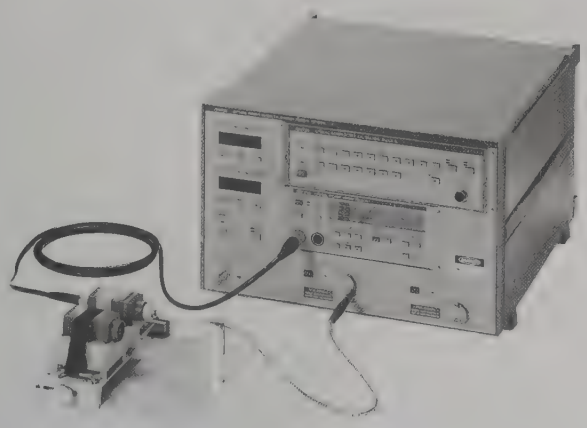
Model number/ Order number	Name		Remarks
	Main frame		
ML910A	Optical Power Meter		
	Standard accessories		
J0017	Power cord, 2.5m:	1	
J0313	Sensor connecting cord A, 2m*1:	1	With 20-pole connector
J0314	Sensor connecting cord B, 2m*2:	1	With 12-pole connector
	Fuse for ML910A, 1A:	2	MF51NN250V1AAC05
	Fuse for ML910A, 2A:	1	MF51NN250V2ADC01
	ML910A Operation manual:	1	
	Optical sensors		
MA9801A	Optical Power Sensor		0.38 to 1.15μm, −90 to 0dBm
MA9301A	Optical Power Sensor		0.75 to 1.7μm, −90 to 0dBm
MA9802A	Optical Power Sensor		0.38 to 1.15μm, −65 to +10dBm
MA9302A	Optical Power Sensor		0.75 to 1.8μm, −40 to +10dBm
MA9803A	Feed Through Sensor		0.38 to 1.15μm, −65 to +10dBm, for light traveling throught free space
MA9303A	Feed Through Sensor		0.75 to 1.8μm, −40 to +10dBm for light traveling through free space
MA9804A	Feed Through Sensor		0.38 to 1.15μm, −65 to +10dBm for optical fiber
MA9304A	Feed Through Sensor		0.75 to 1.8μm, −40 to +10dBm for optical fiber
MA9305A	Optical Power Sensor		0.75 to 1.7μm, −60 to +0dBm
	Optical accessories		
MA9001A	Connector Adaptor with FC type connector		FC type, for MA9802A or MA9302A
MA9001A-Opt 21	Connector Adaptor with D4-type connector		D4 type*3, for MA9802A or MA9302A
MP915A	Fiber Adaptor with FC-type plug		With FC-type plug, for fiber with 125μm clad dia. 0.3 to 1 mm jacket dia.
MP915A-Opt 21	Fiber Adaptor with D4-type plug		With D4-type plug, for fibers with 125μm clad dia. 0.3 to 1 mm jacket dia.
MA9002A	Adaptor		For MA9802A or MA9302A (fit to the MP93A)
MP93A	Fiber Adaptor		For fibers with clad diameters of less than 150μm 0.8 to 1.0 mm jacket dia.
MA9805A	Optical Attenuator		Used with MA9802A (attenuation: 10dB)
MA9306A	Optical Attenuator		Used with MA9302A (attenuation: 10dB)
J0007	GP-IB cable, 1m		
J0008	GP-IB cable, 2m		

*1 Sensor connecting cord A: for MA9801A or MA9301A
*2 Sensor connection cord B: for MA9802A, MA9302A, MA9803A, MA9303A, MA9804A, MA9304A and MA9305A
*3 FC-type to D4-type optical connector modification: specify option 21

Optical Power Meter Calibration System
MT9501A/B/C

0.85 μm/1.3 μm

NEW



Features

- Traceable to ETL and NBS
- Highly accurate calibration: ±3%
- Highly stable measurement jigs
- Compact and easy-to-use

Description

The MT9501A/B/C System is for calibrating optical power meters by using standard optical power; and for calibrating indicators by using current and voltage.

It can calibrate optical power meters to a high accuracy of ±3% to confrom with ETL*1 and NBS*2 traceable standards. The indicators of all Anritsu power meters can be calibrated by using the standard current and voltage.

This system is applicable to optical power calibration wavelength of 0.85 μm and 1.3 μm and consists of three models: the MT9501A for both wavelengths; the MT9501B for 0.85 μm; and the MT9501C for 1.3 μm. Each MT9501A/B/C consists of an optical power meter calibrator, stablized light source, and standard optical power meter, housed in a single cabinet. Anritsu's special semi-rigid optical fiber cable and optical sensor calibration base prevent errors due to bending of the optical fiber etc.

The system is best suited for transfer standards or optical power working standards.

*1 ETL: Electrotechnical Laboratory (Japan)
*2 NBS: National Bureau of Standards (U.S.A.)

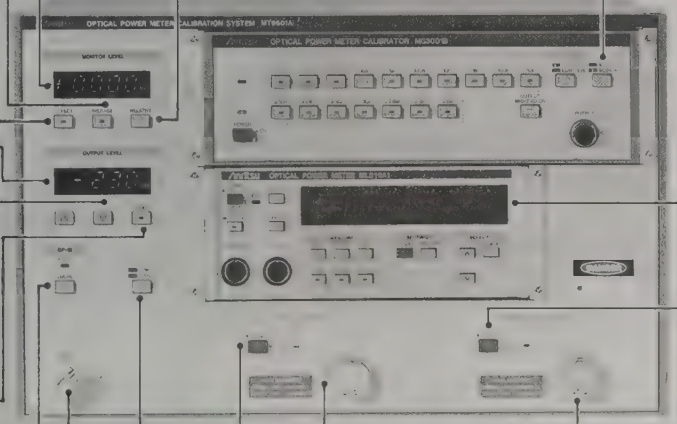
Specifications

System model			MT9501A		MT9501B	MT9501C	Remarks
Stabilized Light Source	Unit model		MT0901A	MT0902A	MT0901A	MT0902A	
	Center wavelength		850±10nm	1300±20nm	850±10nm	1300±20nm	LD
	Optical output		−25 to +5dBm	−25 to 0dBm	−25 to +5dBm	−25 to 0dBm	*1
	Output stability		within 0.01dB				*2
	Setting resolution		0.1dB				
	Monitor display resolution		0.001dB				
Optical Power Meter ML910A1	Optical power sensor model		MA9308A	MA9501A	MA9308A	MA9501A	
	Calibration level		0dBm, −10dBm, −23dBm				
	Calibration accuracy		±3%				Accuracy including ML910A1
Optical Power Meter Calibrator MG3001B	Current output range		Current equivalent to −60 to +10dBm indication, in 5dB steps, 15 points				High-level mode
	Voltage output range		Voltage equivalent to −80 to 0dBm indication				Low-level mode
	Output accuracy	Current	±0.05% to ±0.5%				Used indicator calibration
		Voltage	±0.02% to ±0.2%				
Ambient temperature, rated range of use			23.5±5°C				
Dimensions and weight			Approx, 266H×426W×450Dmm, ≦30kg				
Power			AC **V, 50/60Hz				
Accessories supplied			Two semi-rigid optical fiber cables (one each for MT9501B/C) One optical sensor calibration base One each of optical sensor connecting cords "A" and "B" One each of indicator connecting cords "A" and "B" One accessory case One check cord Four optical sensor holders				

*1 When the supplied GI fiber cord with FC-PC plug is connected
*2 ±1°C temperature change for one min. within the rated temperature range
*3 FC-type connector is standard. Calibration of optical power meters with the connectors listed below is possible using the special standard optical sensor with specified connector (sold separately) and conversion cable (sold separately).
D4, RUNGE, DIAMOND, AMPHENOL 905/906, DIN
**Specify one nominal line voltage between 100V and 250V when ordering.

Notes for ordering
- Generally, additional orders only for the light source units cannot be accepted.
  For special orders, your MT9501A/B/C must be returned to our factory for modification.
- The MG3001B Optical Power Meter Calibrator is available as a single unit.

MT9501A Front Panel



RELATIVE switch
When pressed, optical power fluctuation value indicated

Monitor level indicator
Indicates fluctuation in stabilized light source optical power

AVERAGE switch
Processes to average

Optical power meter calibrator
Generates voltage and current to electrically calibrate Anritsu optical power meter indicators ML93A/B, ML94A, ML96A/B, and ML910A

OFFSET switch
Adjusts stabilized light source internal monitor sensor to zero

Standard optical power meter
Receives optical power emitted from stabilized light source with optical sensor and indicates value

Calibration level indicator
Indicates calibration level of optical power meter

Calibration level setting switch
Sets calibration level

Optical output switch
Turns 1.3 μm optical output on and off

FINE switch
Controls stabilized light source so optical power set by setting switch matches ML910A1 indication

Optical output connector
Emits 0.85 μm optical power

Optical output connector
Emits 1.3 μm optical power

LOCAL switch
Releases REMOTE state

Optical output switch
Turns 0.85 μm optical power on and off

Power supply switch
Turns power on and off

Wavelength switch
Selects calibration wavelength

Optical Power Meter Calibration System Application Example

1. Indicator calibration with current and voltage

As shown in Fig. 1, the optical power meter indicator being calibrated is connected to the MG3001B Optical Power Meter Calibrator.

Fig. 1

2. Calibration with optical power

2.1 Supplying calibration level optical power

①As shown in Fig. 2, connect one end of the semi-rigid optical fiber cable to the optical output connector of the light source unit, and the other end to the standard power sensor.

②Set the calibration level with the calibration level setting switch of the MT9501A. Press the FINE switch to output calibration level optical power.

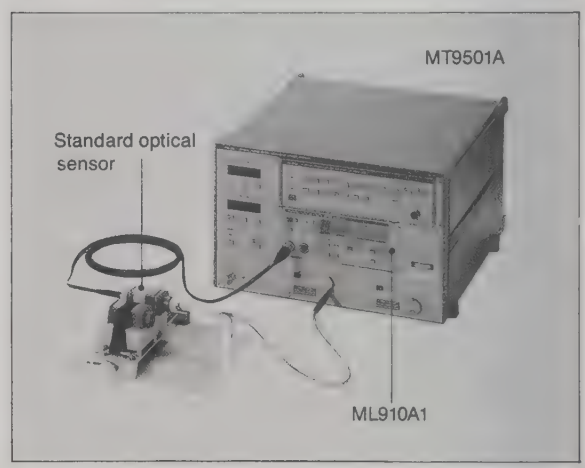


Fig. 2

2.2 Optical power meter (indicator + Optical sensor) calibration

As shown in Fig. 3, connect the semi-rigid optical fiber cable to the optical power sensor being calibrated.

Compensate the sensitivity of the optical power sensor being calibrated so that the optical power meter indicates the calibration level value.

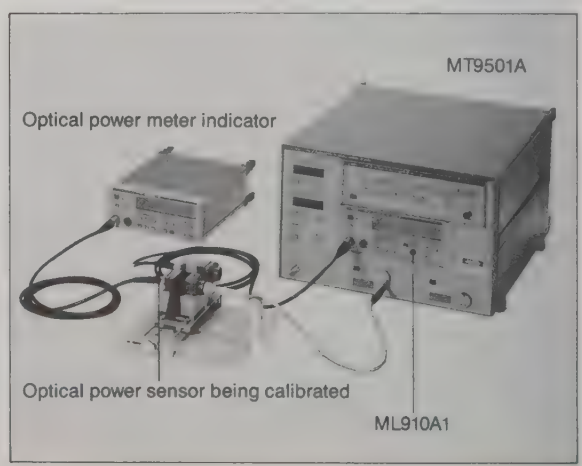


Fig. 3

Ordering Information

Please specify model/order number, name and quantity when ordering.

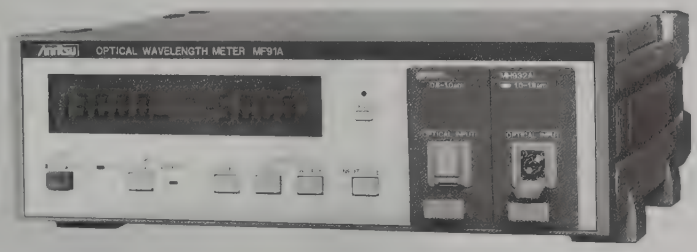
Model/Order No.	Name		Remarks
	—Main frame—		
MT9501A	Optical Power Meter Calibration System		Calibration wavelength 0,85μm, 1.3μm
MT9501B	Optical Power Meter Calibration System		Calibration wavelength 0.85μm
MT9501C	Optical Power Meter Calibration System		Calibration wavelength 1.3μm
	—System components—		
MT0901A	Stabilized Light Source Unit		For MT9501A/B
MT0902A	Stabilized Light Source Unit		For MT9501A/C
MT910A1	Optical Power Meter		For MT9501A/B/C
MA9308A	Optical Power Sensor		For MT9501A/B, with FC connector
MA9501A	Optical Power Sensor		For MT9501A/C, with FC connector
MG3001B	Optical Power Meter Calibrator		For MT9501A/B/C
	—Standard accessories—		
J0378	Semi-rigid optical fiber cable, 0.5m:	*pcs	For MT9501A: 2pcs For MT9501B/C: 1pc } with PC-FC plug
J0313	Optical Power Sensor connecting cord A, 2m:	1pc	For MG3001B-ML910A connection
J0314	Optical Power Sensor connecting cord B,2m:	1pc	For ML 910A1-MA9308A/MA9501A connection
J0379	Indicator connecting cord A, 2m:	1pc	For MG3001B-ML93A/B, ML94A connection
J0380	Indicator connecting cord B, 2m:	1pc	For MG3001B-ML96A/B connection
J0381	Check cord, 1m:	1pc	For MG3001B calibration
J0017	Power cord, 2.5m:	1pc	
B0192	Optical Sensor Calibration Base:	1pc	MA95A, MA96A/E calibration possible
B0193	Optical Sensor Holder A:	1pc	For MA9801A, MA9301A
B0194	Optical Sensor Holder B:	1pc	For MA9802A, MA9302A, MA9305A
B0195	Optical Sensor Holder C:	1pc	For MA97A/B, MA98A, MA911A, MA913A/E, MA916A, MA917A/E
B0196	Optical Sensor Holder D:	1pc	For MA912A
B0197	Screwdriver for adjustment:	1pc	For optical sensor sensitivity adjustment
B0191	Accessory case:	1pc	
	Fuses for MT9501A/B/C, 3.15A:	2pcs	MF51NN250V3.15AAC05
	Fuse for MT9501A/B/C, 1.6A:	1pc	MF51NN250V1.6ADC01
	Fuses for MT9501A/B/C, 1A:	2pcs	MF51NN250V1ADC01
	Fuses for MT9501A/B/C, 0.2A:	3pcs	MF51NN250V0.2ADC01
	Fuses for MT0901A, 1A:	2pcs	MF51NN250V1ADC01
	Fuses for MT0902A, 1A:	2pcs	MF51NN250V1ADC01
	Fuse for ML910A1, 1.6A:	1pc	MF51NN250V1.6AAC05
	Fuses for ML910A1, 1A:	2pcs	MF51NN250V1AAC05
	Fuse for ML910A1, 2A:	1pc	MF51NN250V2ADC01
	Fuses for MG3001B, 1A:	2pcs	MF51NN250V1AAC05
	Fuse for MG3001B, 1.6A	1pc	MF51NN250V1.6ADC01
	Fuse for MG3001B, 0.8A	1pc	MF51NN250V0.8ADC01
	Fuses for MG3001B, 0.315A:	2pcs	MF51NN250V0.315ADC01
	MT9501A/B/C Operation Manual:	1copy	

Continued on next page

(Continued)

Model/Order No.	Name	Remarks
	—Optional accessories—	
J0007	GP-IB cable, 1m	
J0008	GP-IB cable, 2m	
	—Repairing materials—	
Z0082	Heat shrinking tube for MA97A/B, MA98A, MA911A	
Z0083	Name plate for MA9801A	
Z0084	Name plate for MA9301A	
Z0085	Name plate for MA9802A	
Z0086	Name plate for MA9302A	
Z0087	Name plate for MA9805A	

Optical Wavelength Meter
MF91A



《GP-IB》

Description

The MF91A can measure wavelength of LD or LED. This unit can also measure optical power directly without setting the wavelength over a wide wavelength range.

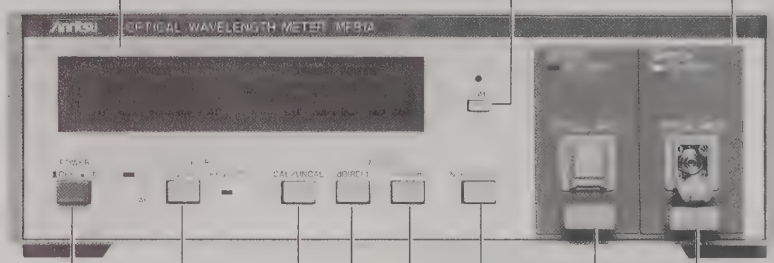
Features

- Wide wavelength range
  Three plug-in units cover the wavelength range of 0.4 to 1.6 μm.
- Optical power measurement
  Optical power can be measured over the entire wavelength range without recalibrating the wavelength sensitivity.
- Wide measurement range
  Measurement can be performed for an extremely wide input level range: −60 to +10 dBm (at 0.85 μm).
- Optical connector input
  Connector input enables easy measurement.

Specifications

Indicator	Display	Wavelength 5 digits Power 4 digits W/dBm/dB (REL) selectable Simultaneous indication of wavelength and power		
	Analog output	Analog output corresponding to the wavelength and power		
	GP-IB	Standard feature		
	Power	100 V, 50/60 Hz, ≦20 VA		
Plug-in unit	Model	MH930A	MH931A	MH932A
	Wavelength range	0.4 to 0.8 μm	0.6 to 1.0 μm	1.0 to 1.6 μm
	Level range	−55 to +10 dBm (at 0.633 μm)	−60 to +10 dBm (at 0.85 μm)	−50 to +5 dBm (at 1.3 μm)
	Optical connector	FC type		
Overall	Wavelength accuracy	Within ±0.5% When the spectral half width is less than 10 nm		
	Measurement level accuracy	±0.3 dB (−10 dBm, 0.633 μm)	±0.3 dB (−10 dBm, 0.85 μm)	±0.3 dB (−10 dBm, 1.3 μm)
	Wavelength resolution	0.1 nm		
	Level measurement resolution	W indication: 0.1 to 1%, dBm indication: 0.01 dB		
	Ambient temperature, rated range of use	0 to 40°C		
	Dimensions and weight	88 H, 283 W, 251 D mm, ≦6 kg (When two units are installed)		

Front panel



Indicator for wavelength and optical power

Switch for LCD back lighting

LED indicating the unit selected

Power ON/OFF switch

GP-IB switch for releasing the remote control condition

Changeover switch for CAL/UNCAL

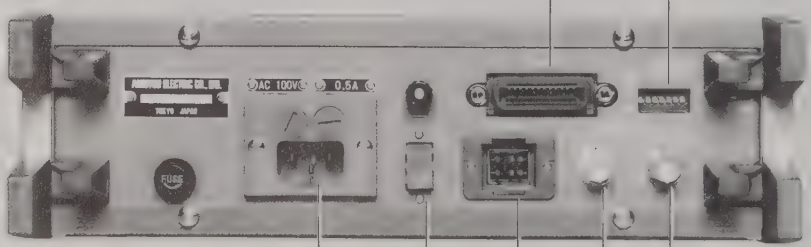
Plug-in unit

Input unit (plugged-in) selection switch

Changeover switch for W and dBm

Switch for setting dB (REL)

Rear panel



GP-IB connector

Address switch

Analog output of wavelength

Analog output of optical power

Input terminal for DC power

Input terminal for AC power

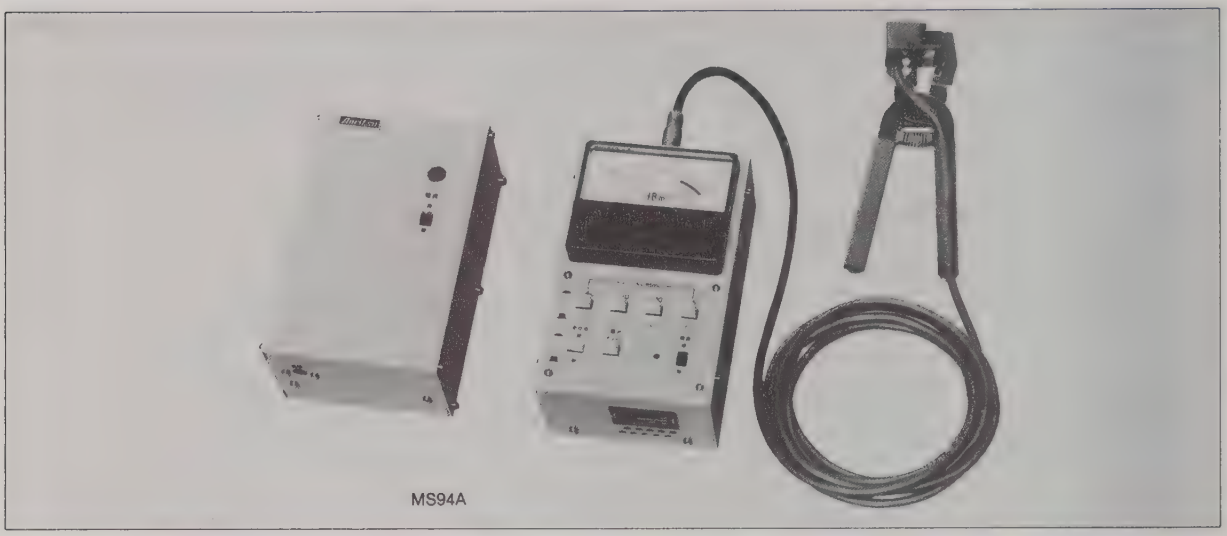
Changeover switch for AC/DC power

Ordering Information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MF91A	Optical Wavelength Meter		
	Standard accessories		
J0017	Power cord, 2.5m:	1 pc	
	Fuse for MF91A, 0.5A:	2 pcs	MN51NN250V0.5AAC05
	Fuse for MF91A, 2A:	1 pc	AMN51NN250V2ADC01
	MF91A Operation Manual:	1 copy	
	Plug-in units		Supplied each with operation manual
MH930A	Plug-in Unit		For 0.4 to 0.8μm band
MH931A	Plug-in Unit		For 0.6 to 1.0μm band
MH932A	Plug-in Unit		For 1.0 to 1.6μm band
	Optional accessories		
MA918A	Light-Emitting Element Measuring Unit		

Optical Fiber Tester
MS94A/MS97A


MS94A

Features

- Small, lightweight, and portable.
- Optical fiber cables can be checked for faults without cutting the cables.
- Optical fiber losses can easily be measured.
- Battery operation of the transmitting section and receiving section is possible.

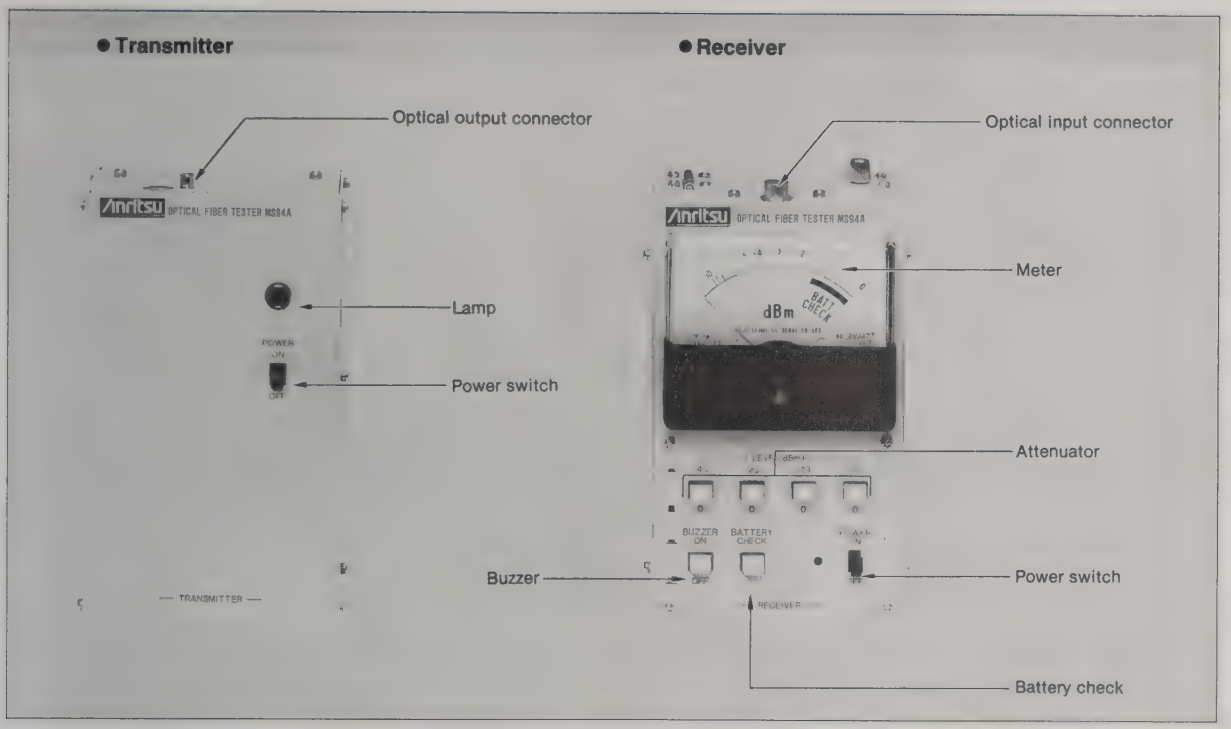
Description

These testers contain both transmitting section and receiving section, and used for fiber identification, simple loss measurement and detection of break in a fiber. They can be used in the installation and maintenance of optical fiber cables. Faults can be located without cutting the cables. The MS94A is used with multi-mode fibers (50/125 μm, NA 0.2) for the 0.85 μm band; the MS97A can be used with either multi-mode or single-mode fiber (10/125 μm, NA 0.1) for the 1.3 μm band.

A highly stable, powerful laser diode with automatic output control is used as the light source in the transmitting section.

The optical signal is modulated with a 270Hz rectangular wave in the transmitting section and demodulated in the receiving section after passing through the optical cable, and the measured power is displayed. If the receiver input level has been previously set, a buzzer will sound when any signal higher than that level is input, so that fiber identification can be easily compared.

The transmitting section includes a rechargeable battery, and can be operated for up to five hours. Floating operation is also possible. The receiver section uses a manganese battery (S-006P) and can be operated for up to 10 hours.



Specifications

● MS94A/MS97A

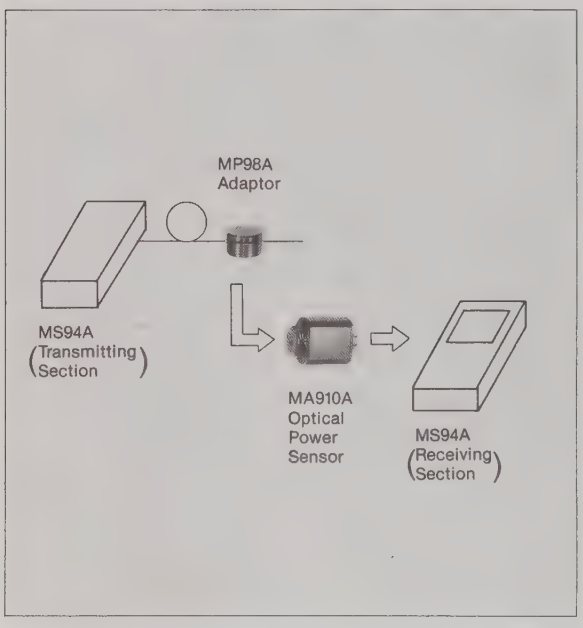
Model			MS94A	MS97A
Transmitter	Wavelength		0.85 ±0.03 μm	1.3 ±0.02 μm
	Spectrum width		≦0.002 μm	≦0.005 μm
	Output	Modulation	Intensity-modulation frequency 270 Hz ±0.5%, duty factor 50%	
		Optical power (mean value)	−10 dBm min (Multi-mode fiber: 50/125 μm, NA 0.2)	−7 dBm min (Single-mode fiber: 10/125 μm, NA 0.1)
Receiver	Power measuring range		−80 to 0 dBm 15 ranges (5 dB steps)	−75 to 0 dBm 13 ranges (5 dB steps)
	Accuracy		−5dBm : ±0.5dB −10dBm: ±1dB −20dBm: ±1dB −40dBm: ±2dB −60dBm: ±3dB −75dBm: ±4.5dB	−5dBm : ±0.5dB −10dBm: ±1dB −20dBm: ±1dB −40dBm: ±2dB −60dBm: ±3dB −65dBm: ±4.5dB
	Buzzer operation		When indicated power exists within full scale to −10 dB in each range, the buzzer operates	
Power			Transmitter: internal rechargeable battery floating use is permitted Receiver: one of mangan battery S-006P (6F22: IEC)	
Ambient temperature, rated range of use			0 to 40°C	
Dimensions and weight			Transmitter: 150H, 90W, 60D mm, ≦1kg Receiver: 150H, 90W, 50D mm, ≦1kg	
Accessories supplied			One MA910A Optical power sensor One MA99A Optical power sensor	One MA914A Optical power sensor One MA915A Optical power sensor
			One MP98A Adaptor One Battery charger One Optical fiber cord (3m) One MP99A Connector adaptor	

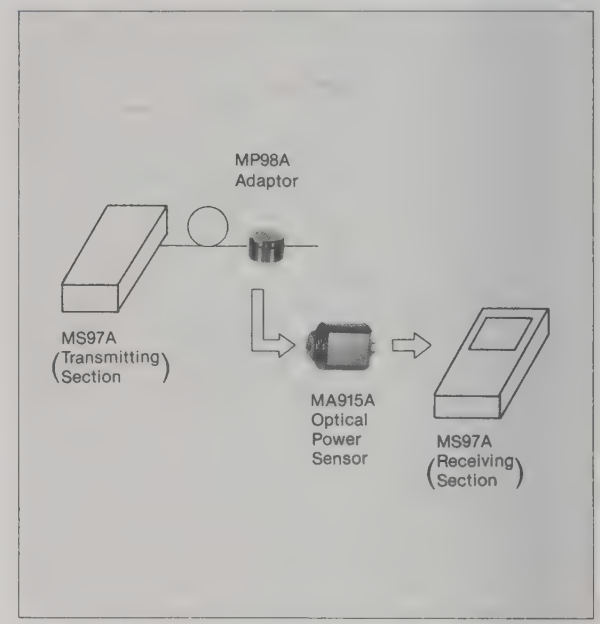
Applications

● Fault detection

Light which is traveling through an optical fiber is scattered wherever a fault occurs and leaks out of the fiber.

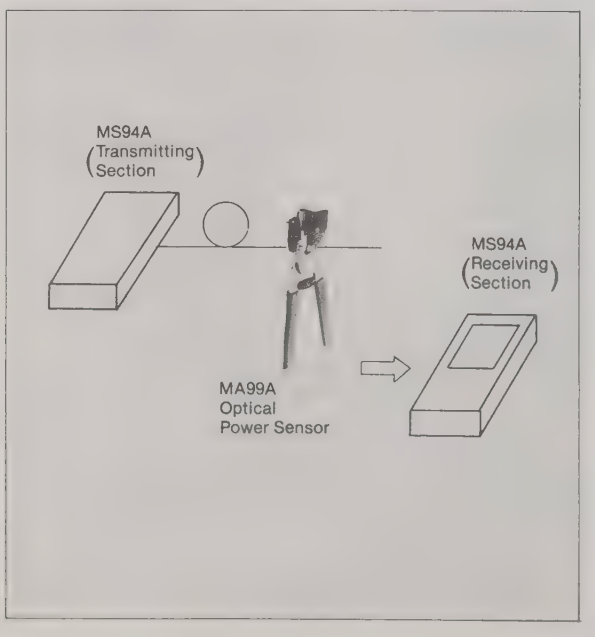
A suspect optical fiber is inserted into and moved through a groove in the side of the MP98A Adaptor, and the scattered light from the fault is detected.

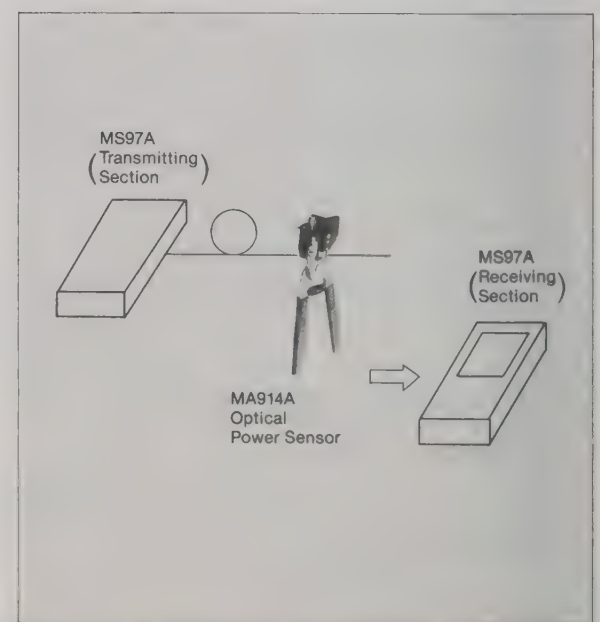




● Simple loss measurement

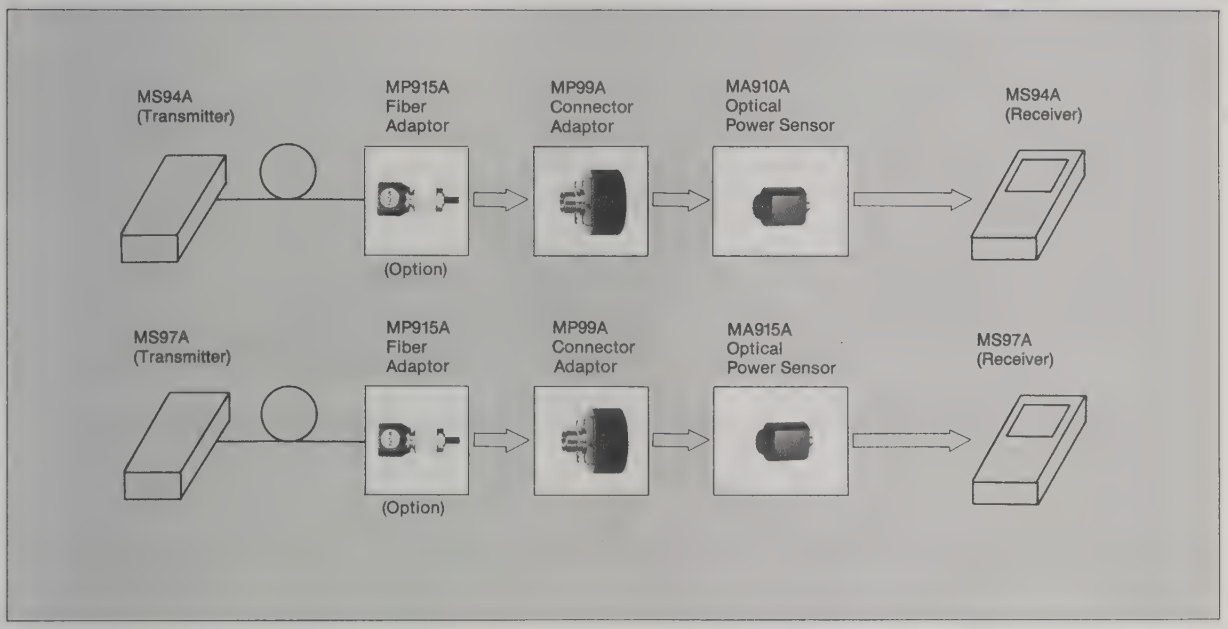
The optical fiber is inserted into an MA99A (MA914A) Optical Power Sensor and the leakage is measured. The detected leakage is about 20dB to 50dB weaker than the light traveling through the fiber. This permits the optical power sensor to estimate the optical power without cutting the fiber.



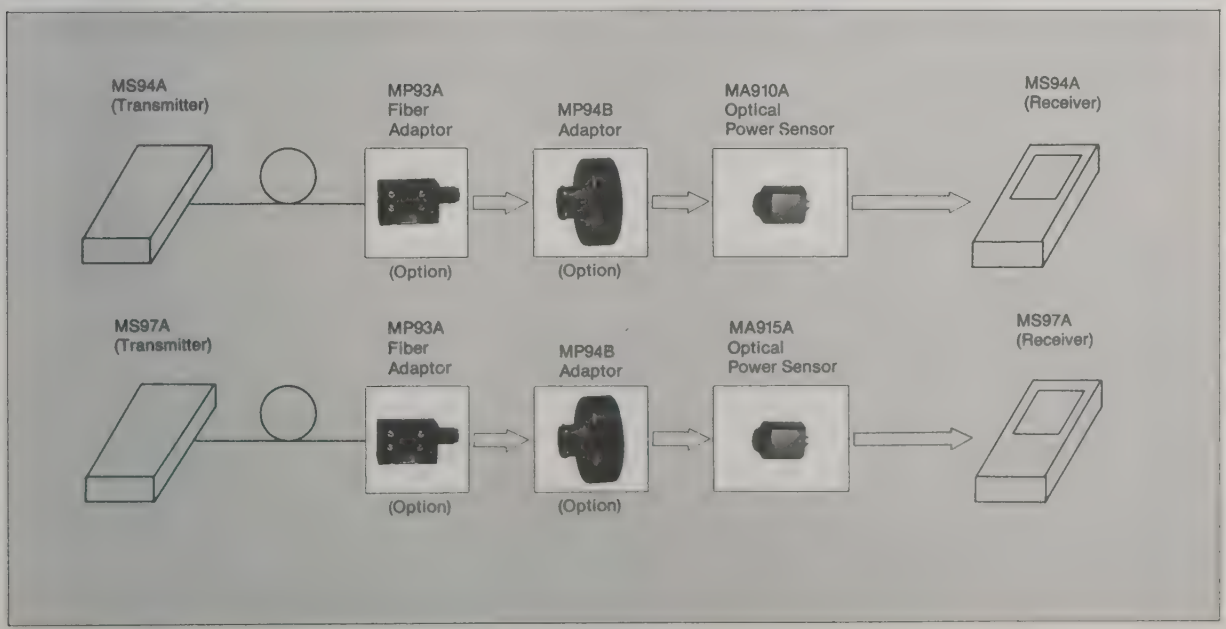


● **Measuring optical losses inside fibers**

(1) By using the configurations shown below, this equipment can measure optical loss. The MS94A is used for multi-mode fiber, while the MS97A can be used for both multi-mode and single-mode fibers.



(2) By using the configurations shown below, this equipment can measure optical loss, too (1 mm dia.).

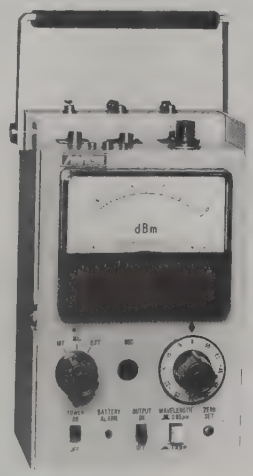


Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MS94A	Optical Fiber Tester		For 0.85 μm
MS97A	Optical Fiber Tester		For 1.3 μm
	Standard accessories		
	• Accessories of the MS94A		
MA99A	Optical Sensor:	1 pc	
MA910A	Optical Sensor:	1 pc	
MP98A	Adaptor:	1 pc	
MP99A	Connector Adaptor:	1 pc	
J0200C	Optical fiber cord, 3 m:	1 pc	
G0018	Battery Charger:	1 pc	For transmitter
G0026	S-006P dry cell (IEC: 6F22):	1 pc	For receiver
	Fuse for MS94A, 2 A:	1 pc	For transmitter MF51NN250V2AAC05
	MS94A Operation manual:	1 copy	
	• Accessories of the MS97A		
MA914A	Optical Sensor:	1 pc	
MA915A	Optical Sensor:	1 pc	
MP98A	Adaptor:	1 pc	
MP99A	Connector Adaptor:	1 pc	
J0200C	Optical fiber cord, 3 m:	1 pc	
G0018	Battery Charger:	1 pc	For transmitter
G0026	S-006P dry cell (IEC: 6F22):	1 pc	For receiver
	Fuse for MS97A, 2 A:	1 pc	For transmitter MF51NN250V2AAC05
	MS97A Operation manual:	1 copy	
	Optional accessories		
MP915A	Fiber Adaptor		125 μm clad dia., 0.3 to 1.0 μm jacket dia.

Optical Tester
MS93A/MS95A



MS93A

Features

- The capability for internal modulation allows measurements to be made at a stable level without interference from stray light.
- The light can be voice modulated, permitting testers to be used for communication during installation of optical fiber cables.
- Using the external modulation function, the testers can be used as simple E/O converters.
- Both units include a rechargeable battery, and can be operated for up to 4 hours (floating operation is also possible).
- The testers are small, lightweight, and portable.

Description

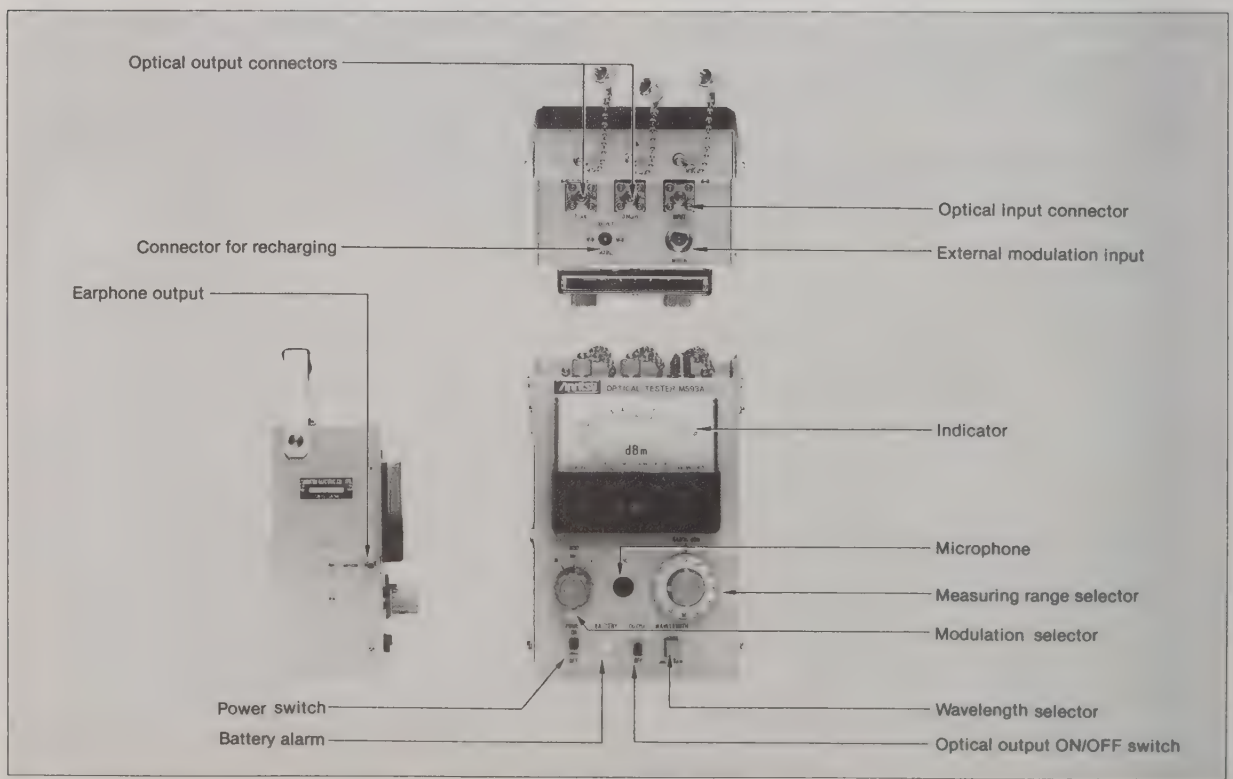
In both the MS93A and the MS95A Optical Testers, the transmitter section and receiver section are included in a single cabinet. The output wavelength of the transmitter in the MS93A is 0.85 μm or 1.3 μm; in the MS95A, it is 0.85 μm. Both use a temperature compensated, highly stable LED as the light source. These convenient testers can be used to measure losses in optical fiber cables and associated devices during construction or maintenance of communication systems using multimode fiber (50/120 μm, NA 0.2). They can be employed as simple E/O converters, and can also test the functions of an optical receiver. If a pair of testers is used, voice communication is possible.

Specifications

MS93A/MS95A

	Model	MS93A	MS95A
Transmitter	Wavelength	0.85 ±0.02μm and 1.30 ±0.03μm	0.85±0.02μm
	Spectral bandwidth	≦0.05μm (0.85μm) ≦0.14μm (1.30μm)	≦0.05μm
	Output power	≧ −25dBm	
	Connector	FC type	
	Output stability	0.3dB	
	Frequency response of external modulation	≦6dBm max (1 to 10MHz)	
	External modulation input	0dBm, 75Ω, connector: SP type	
	Internal modulation frequency	270Hz	
Receiver	Input level	−5 to −60dBm, 5dB step, 12 ranges	
	Connector	FC type	
	Accuracy	0.5dB	
Voice communication		Available	
Power		Rechargeable battery installed	
Ambient temperature, rated range of use		0 to 40°C	
Dimensions and weight		160H, 100W, 70D mm, ≦1kg	
Accessories supplied		One charger, one earphone, two fiber cords (FC type plugs attached at both end), one carrying case	

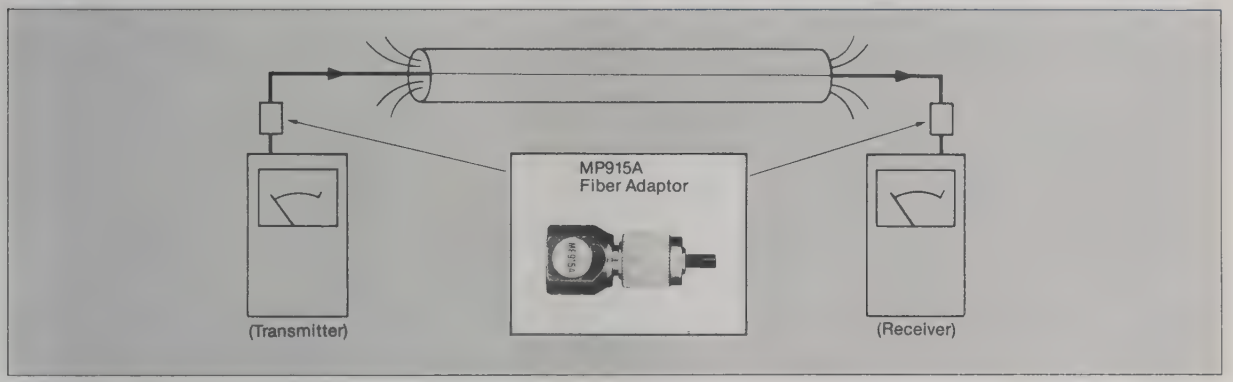
*: The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.



Applications

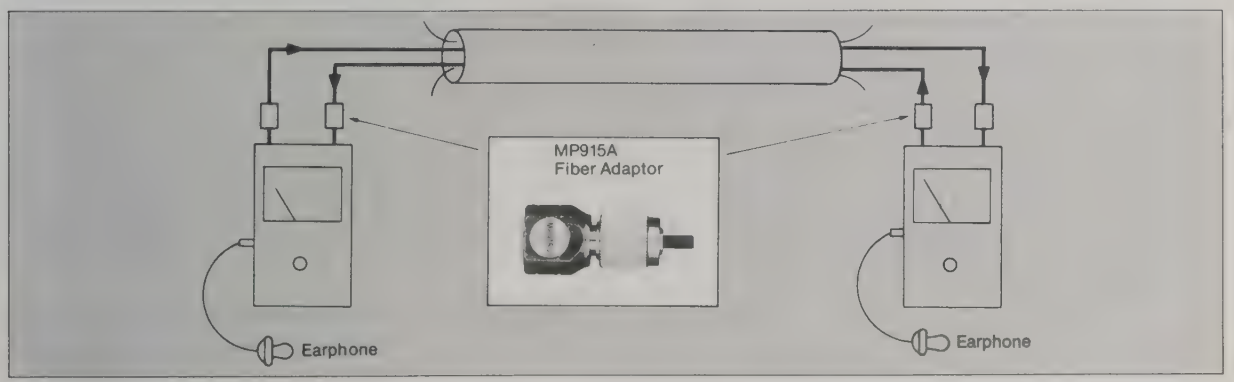
● Measurement of losses in optical fiber cables

Losses are measured by setting the modulation switch to INT.



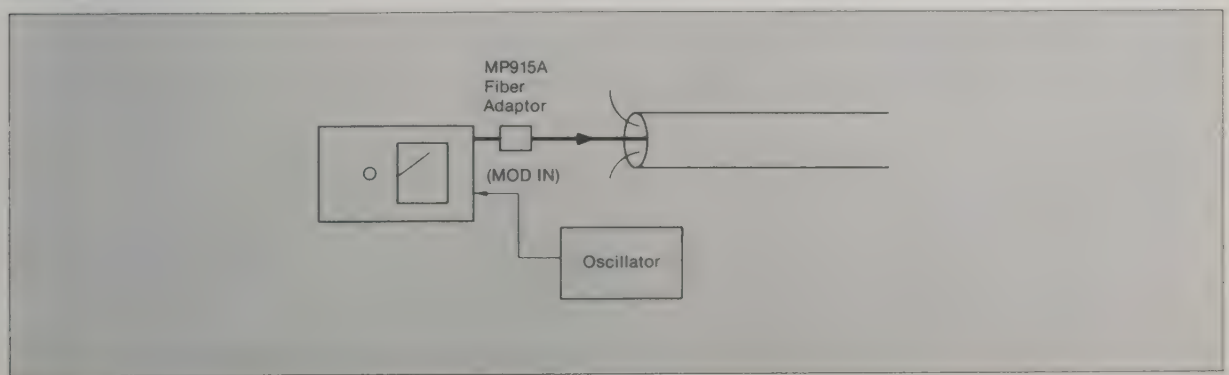
● Intercom function

If the modulation switch is set to MIC, the built-in microphone can be used for voice communications. This is useful during installation of optical fiber systems.



● E/O converter

If the modulation switch is set to EXT, 1 MHz to 10 MHz external modulation is possible.

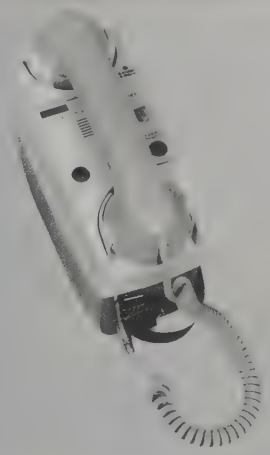


Ordering information

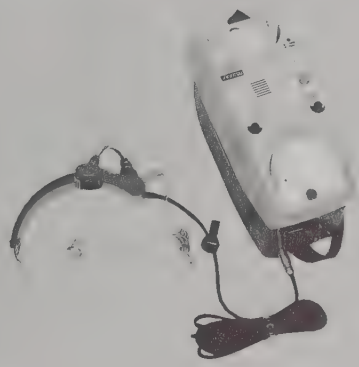
Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MS93A	Optical Tester		
MS95A	Optical Tester		
	Standard accessories		
J0200B	Optical fiber cord, 2 m:	2 pcs	
G0019	Battery Charger:	1 unit	
A0001	Earphone:	1 pc	
B0057	Carrying Case:	1 unit	
	MS93A Operation manual:	1 copy	Supplied with each model
	MS95A Operation manual:	1 copy	
	Optional accessories		
MP915A	Fiber Adaptor		For 0.3 to 1.0 mm jacket diameter (clad diameter 125 μm)

Optical Portable Telephone
MS98A



Handset



Headset (option)

Features

- Two-way communication is possible via a single optical fiber cable.
- Both GI and SM fiber cables can be used.
- Wide dynamic range.
  (37 dB: 46 km for SM fiber cable of 0.8 dB/km)
  (27 dB: 27 km for GI fiber cable of 1 dB/km)
- A call function is provided.
- A handset or a headset can be used.
- Portable type with a built-in rechargeable battery.
- As the audio signal is converted to a PCM signal, the audio quality is not impaired by the communication distance, and good and stable communication and testing can be executed.

Applications

- Communication and testing at the time of installation and maintenance of optical fiber cables.

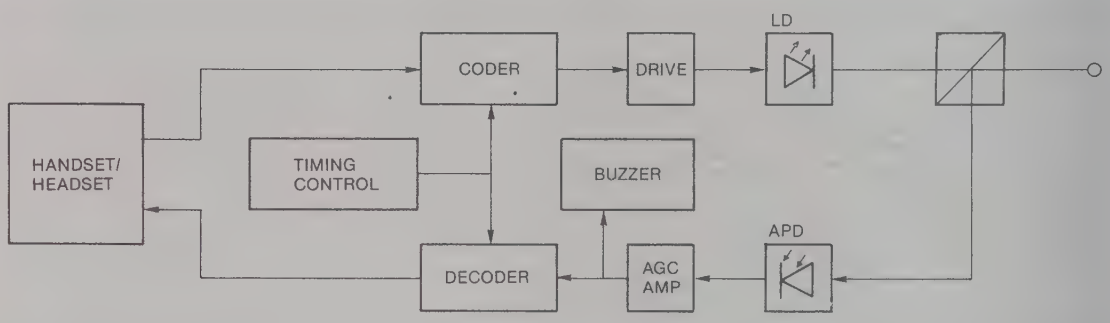
Description

Communication and testing are required at the time of installation and maintenance of optical fiber cables. Communication and testing are executed using metallic cables or radios, but optical fiber cable use for communication and testing is most suitable in regard to communication distance, noise resistance, ease of handling, etc. The Optical Portable Telephone MS98A uses one optical fiber cable to permite two-way communication and testing over max. 46 km (SM fiber cable of 0.8 dB/km). As the audio signal is converted to a digital signal, there is no drop in the audio quality caused by distance, and good and stable communication and testing can be executed. Furthermore, as the Optical Portable Telephone MS98A is a portable type with a built-in rechargeable battery, it can be used easily at any place.

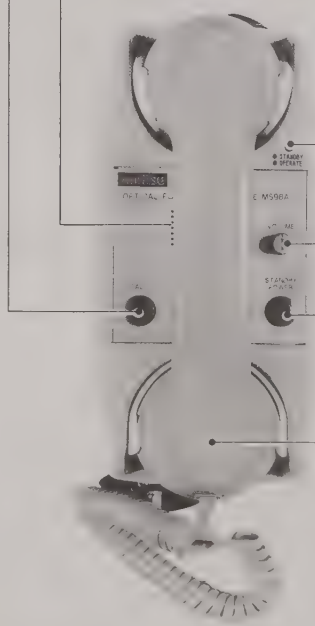
Specifications

	Specifications	Remarks
Optical wavelength	1.31 μm $\pm$0.03 μm	
Optical output level	$\geqq$ – 13 dBm (HIGH) $\leqq$ – 25 dBm (LOW)	Fiber: 10 μm SM, NA 0.09 Average power
Optical receiving level	$\leqq$ – 50 dBm (Fiber: SM, NA 0.09)	Average power
Audio modulation method	PCM	
Optical connector	FC type (SM)	
Power	Built-in rechargeable battery	Continuous operation time: more than 4 hours. Floating operation possible.
Ambient temperature, rated range of use	0 to 50°C	
Storage temperature range	– 40° to 70°C	
Dimensions and weight	206H, 110W, 223D mm, $\leqq$3 kg	
Accessories supplied	One charger One fuse	

Note: The standard optical connector is FC type. For other connectors, please consult Anritsu representative.



Block diagram



CALL/SYNC button
Pushing this button enables two-way communication (sync condition). This pushbutton switch is also used for call signal generation at the time of sync condition.

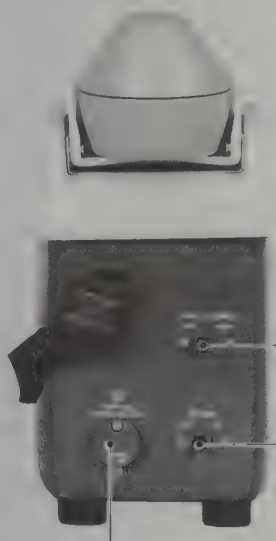
BUZZER
For calling.

Power/sync lamp
The green lamp lights at the time of power ON (standby), and the red lamp lights when synchronization has been obtained. A battery alarm function is also provided, and when the battery voltage drops below the specified value, the red (or green) lamp flashes to indicate insufficient battery capacity.

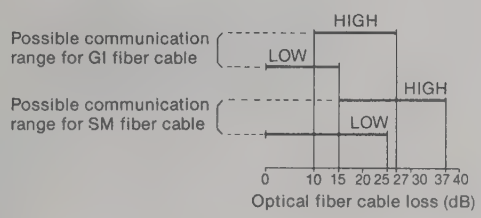
Volume
The volume of the handset can be adjusted.

Standby button
This is the pushbutton switch for return from synchronized condition to standby condition. Power can be saved by switching to standby condition when no communication is taking place.

Handset
A headset (option) can also be connected.



Optical output level selector
The optical output level should be switched according to the optical fiber loss as shwon in the following figure.


Possible communication range for GI fiber cable
HIGH
LOW
Possible communication range for SM fiber cable
HIGH
LOW
0 10 15 20 25 27 30 37 40
Optical fiber cable loss (dB)

Power switch

Optical input/output terminal
This is the terminal for optical fiber cable connection.
It is provided with a protection cover.

External battery terminal
By connection of an external battery (option), the continuous operation time can be extended by 8 hours or more.

Charging terminal
Charging and floating operation are possible by connection of the charger.

Examples for optical fiber connection

Connection of an optical fiber cable with a plug

Connection of a GI optical fiber cable

GI pigtail

MP921B bare fiber adaptor

Connection of an SM optical fiber cable

SM pigtail

MP922B bare fiber adaptor

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main Frame		
MS98A	Optical Portable Telephone		
	Standard accessories		
G0033	Battery Charger:	1 pc	
	Fuse for MS98A:	1 set	
	MS98A Operation manual:	1 copy	
	Optional accessories		
A0005	Headset		
J0306	GI pigtail (FC), 2m		
J0307	SM pigtail (FC), 2m		
B0159	Carrying case (hard)		
B0160	Carrying case (soft)		
G0034	External battery		Lead battery
G0035	Charger for external battery		
MP921B	Bare Fiber Connector		For GI fiber
MP922B	Bare Fiber Connector		For SM fiber

Headset

Pigtail (SM, GI)

Bare Fiber Adaptor MP921B

Carrying Case (Soft type)

External Battery

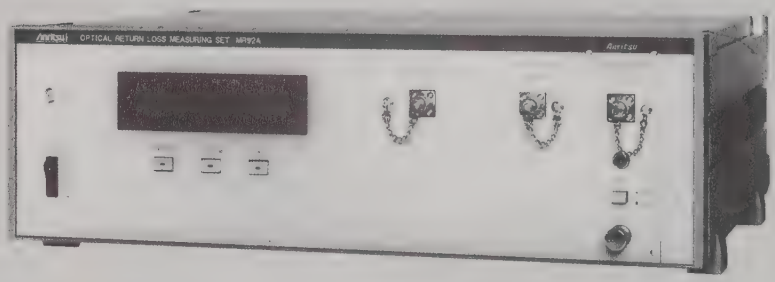
Charger for external battery (option)

Carrying Case (Hard type)

Bare Fiber Adaptor MP922B

Charger (Standard accessory of the MS98A)

Optical Return Loss Measuring Set
MR91A/MR92A



MR92A

Features

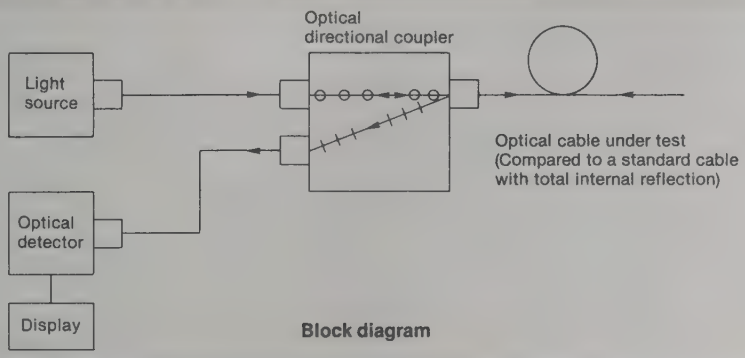
- Wide dynamic range
- Easy measurement
- Wide range of measurement wavelengths available

Applications

- Optical fiber cable far end return loss measurement
- Optical device return loss measurements

Description

The optical return loss measuring set permits direct readout of optical return loss for optical connectors and devices coupled with multi-mode optical fiber (GI 50/125μm, NA 0.2). Five light sources are available: the MH918A (0.81μm), MH927A (0.85μm), MH919A (0.89μm), MH926A (1.2μm) and MH920A (1.3μm). Any one of these can quickly be installed in the MR91A (0.85μm band) or MR92A (1.3μm band), permitting measurements at any desired wavelength.



Block diagram

Specifications (main frame)

Item \ Model	MR91A	MR92A	Remarks
Compatible light source	MH918/919A/927A	MH920A/926A	
Display	3 digits, resolution 0.1dB, dB (CAL setting)		
Averaging	Available (on/off switching)		
Measurement range	0 to 40dB		Compared to a standard cable with total internal reflection
Accuracy	Within 1dB		Comparison measurement, DUT with random polarization only
Connector	FC type		
Power	AC **V ±10%, 50/60Hz, ≦30VA		
Dimensions and weight	133H, 426W, 451Dmm, ≦9 kg		
Ambient temperature, rated range of use	0 to 40°C		
Accessories supplied	One optical cable with total internal reflection coating One optical connection cable One AC cord Two fuses One instruction manual		

Specifications (light source) [sold separately]

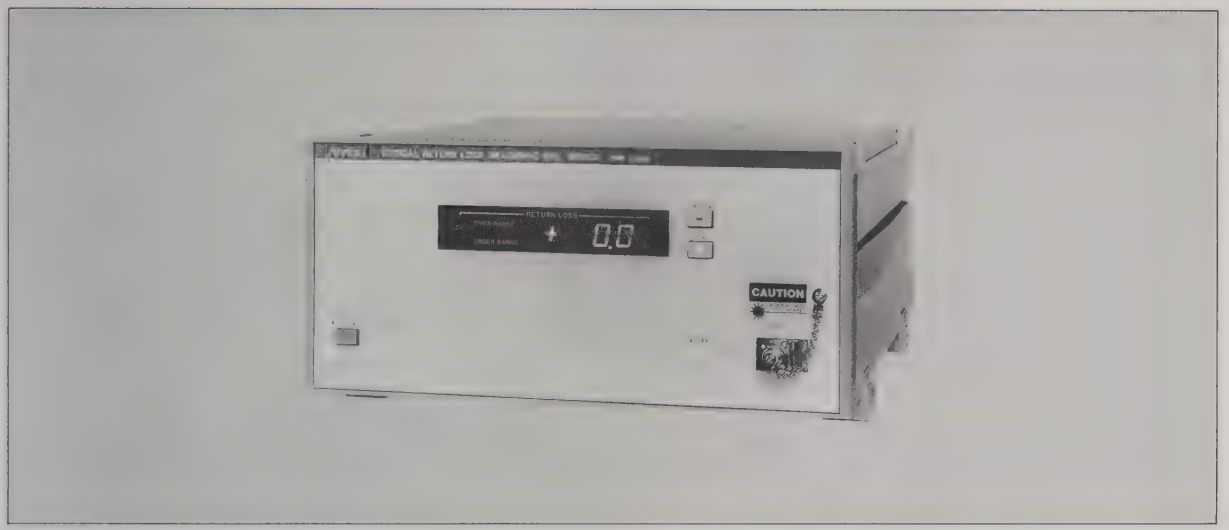
Item \ Model	MH918A	MH919A	MH927A	MH920A	MH926A	Remarks
Wavelength	0.81 ±0.01μm	0.89 ±0.01μm	0.85 ±0.01μm	1.3 ±0.02μm	1.2 ±0.02μm	At 25°C
Spectrum width	0.005μm					At 25°C
Optical output	−6 ±1dBm					Average value
Output stability	≦0.5dB					10 to 35°C within 5 hours
Short-term stability	≦0.1dB					For one minute, at constant temperature of 20 ±1°C
Ambient temperature, rated range of use	0 to 40°C					
Dimensions and weight	126H, 45W, 204Dmm, ≦800g					

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MR91A	Optical Return Loss Measuring Set		
MR92A	Optical Return Loss Measuring Set		
	Standard accessories		
J0201	Total Internal Reflection cord:	1 pc	For GI fiber (a cable with total reflection coating)
J0014D	Optical fiber cord, 0.5 m:	1 pc	For GI fiber
J0017	Power cord, 2.5 m:	1 pc	
	Fuse for MR91A/92A, 2A:	2 pcs	MF51NN250V2AAC05
	Fuse for MR91A/92A, 1A:	1 pc	MF51NN250V1ADC01
	MR91A Operation manual:	1 copy	
	MR92A Operation manual:	1 copy	
	Plug-in units		
MH918A	Stabilized Light Source Unit		For MR91A, 0.81 μm
MH919A	Stabilized Light Source Unit		For MR91A, 0.89 μm
MH927A	Stabilized Light Source Unit		For MR91A, 0.85 μm
MH920A	Stabilized Light Source Unit		For MR92A, 1.3 μm
MH926A	Stabilized Light Source Unit		For MR92A, 1.2 μm

Optical Return Loss Measuring Set
MR93A



Features

- Wide dynamic range
- Easy measurement

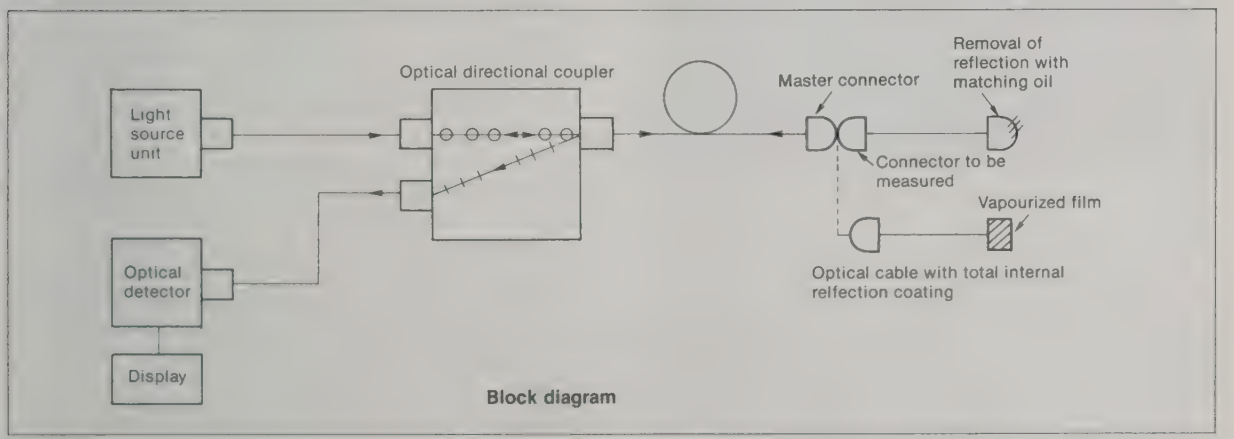
Applications

- Return loss measurement of PC-type optical connectors and optical devices

Description

Optical Return Loss Measuring Set Model MR93A is a measuring set for making measurement on the reflection ratio (return loss) of connecting point of PC-type optical connector suited for single mode optical fiber (SM 10/125 μm, NA 0.1).

Employing a laser diode (LD) of wavelength 1.3 μm for light source, digital indication of reflection in a dB value is made with a reflective level at the time of connection of an optical fiber cord one side of which has been metal-vapourized, as a reference.



Block diagram

Specifications

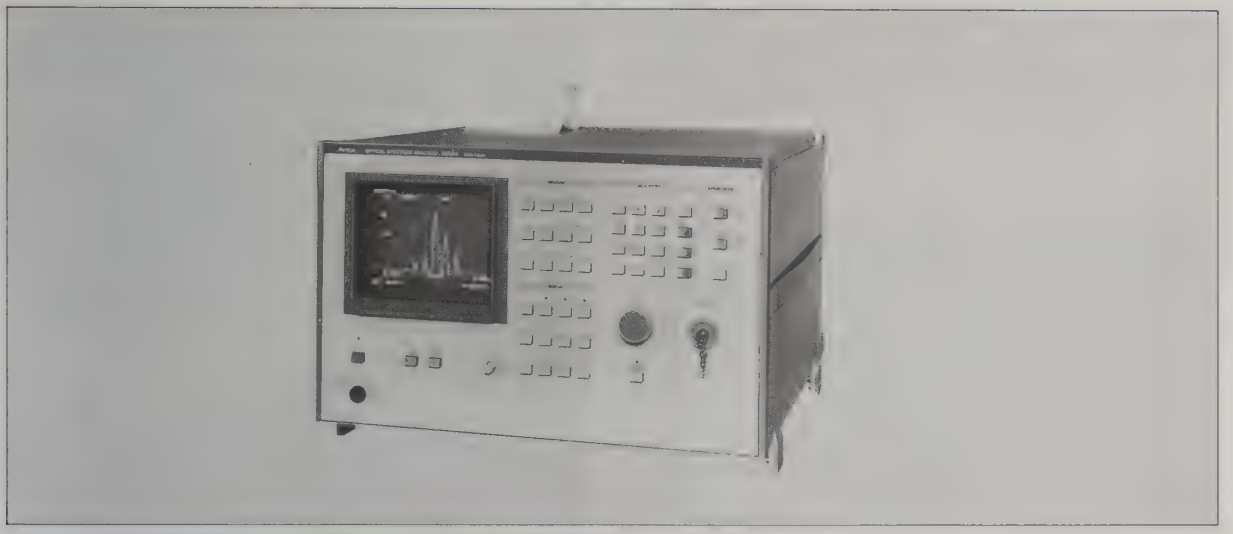
Model	MR93A	Remarks
Wavelength	1.31 ±0.03 μm	
Display	Digital 3 digits Resolution 0.1 dB dB (CAL setting can be done)	
Averaging	Available (on/off switching)	
Measurement range	0 to 35 dB	Compared to a standard cable with total internal reflection
Measurement stability	≦ ±1 dB	
Optical connector	PC type	
Power	100 ±10V, 50/60Hz, ≦50VA	
Ambient temperature, rated range of use	0 to 40°C	
Dimensions and weight	132.5H, 282W, 351D mm, ≦10 kg	
Accessories supplied	Optical cord with total internal reflection coating 1 pc Fuse 2 pcs Power cord 1 pc Operation manual 1 copy	

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MR93A	Optical Return Loss Measuring Set		
	Standard accessories		
	Total internal reflection cord:	1 pc	
J0017	Power cord, 2.5 m:	1 pc	
	Fuse for MR93A, 2A:	2 pcs	MF51NN250V 2AAC05
	MR93A Operation manual:	1 copy	

Optical Spectrum Analyzer
MS99A



Features

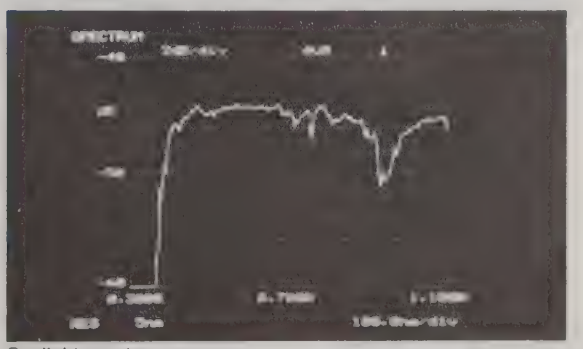
- Wide wavelength range
- Wide dynamic range
- High resolution
- High precision wavelength measurement
- Versatile processing capability
  - •Averaging function
  - •Deduction processing function
  - •Marker function
  - •Data memory function

Description

The MS99A, as well as being used for spectrum observation of light sources such as LDs and LEDs within a wavelength range from 0.35μm to 1.1μm, is capable of measuring the loss-wavelength characteristics of optical fiber, parts and material when it is used in conjunction with a white light source (MG922A).

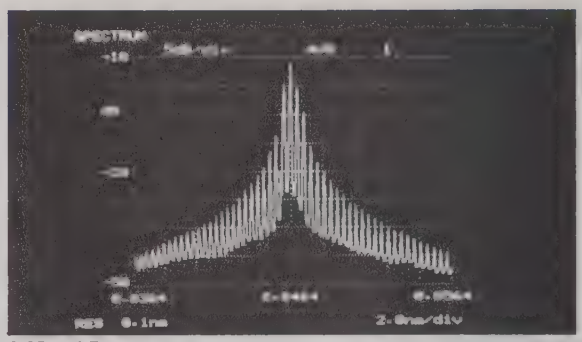
The development of a highly sensitive sensor gives a wide dynamic range. The use of parabolic reflector results in a spectral capability having high accuracy, high resolution and a wide wavelength range. It possesses many outstanding properties such as a high precision, high-speed sweep due to the employment of the DC servomotor method, and versatile processing functions based on its usage of multi-CPUs.

- **Wide wavelength range**
  Having successfully developed an ultra-wide bandwidth, it is no longer necessary to change the monochrometer unit when changing the wavelength band and it is possible to measure from 0.35 to 1.1μm in only 1 sweep.



Sunlight spectrum

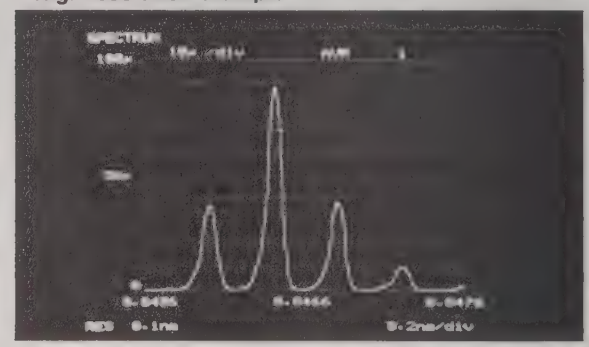
● **Wide measurement level**
Measurement level ranges of 0 to −55dBm (wavelength range of 0.35 to 1.1μm) and 0 to −60dBm (0.45 to 1.0μm) have been actualized with the use of an optical chopper.



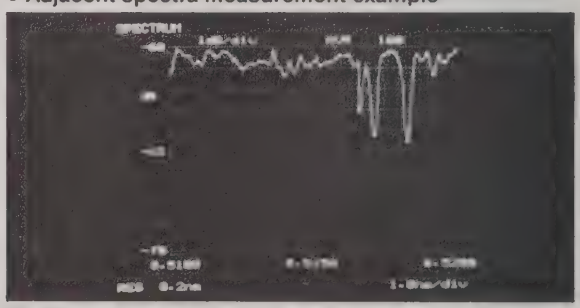
0.85μm LD spectrum

● **High resolution**
When a light source (gas laser, semiconductor laser, etc.) with good monochromaticity is measured, a very sharp spectrum will be observed on a CRT of a spectrum analyzer having good resolution capabilities. The MS99A is able to measure with high resolution as it uses a parabolic reflector in the spectral diffracter. Adjacent spectra in close vicinity can be discriminated thoroughly.

● **High resolution example**

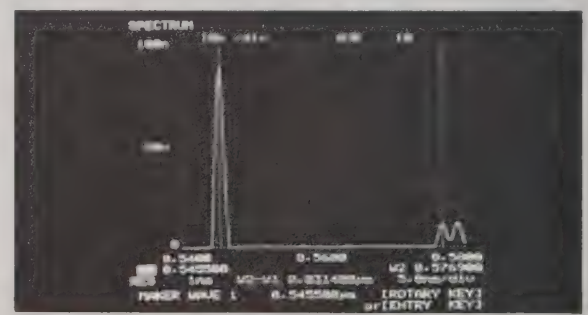


● **Adjacent spectra measurement example**



Sunlight spectrum (Mg)

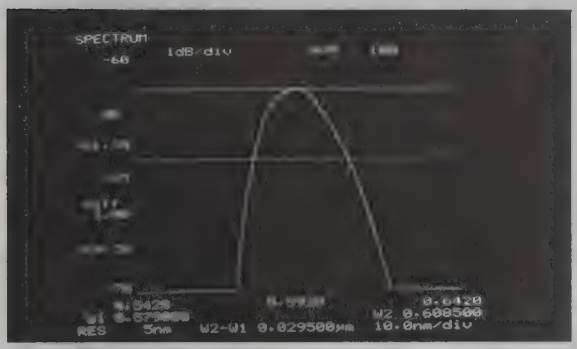
● **High precision wavelength measurement**
It is possible to make high precision wavelength measurements due to the employment of a DC servomotor and a construction suitable for stable optical equipment.



Hg lamp spectrum (with 600μm fiber) (0.54607μm, 0.57696μm, 0.57907μm)

- **Averaging function**
  It is possible to measure low level signals that are masked by noise by improving the S/N ratio.

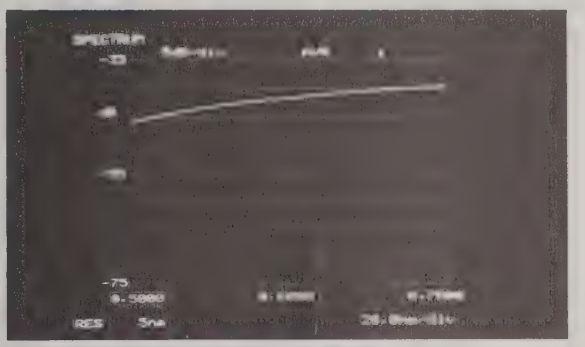
- **Marker function**
  If the marker is moved to the position that is to be measured the value of the wavelength level at the marker point will be displayed on the CRT.



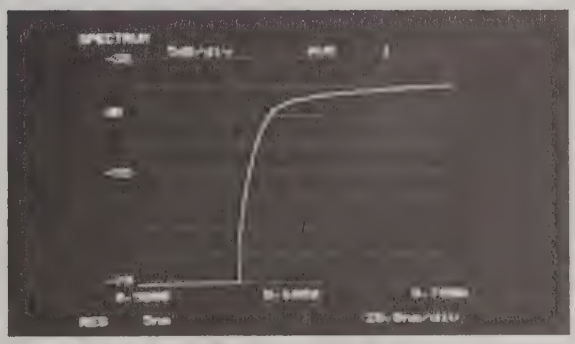
Yellow LED (via a fiber with 600μm diameter)

- **Data memory function**
  The data of 4 measurements are entered into the memory and can be displayed on the CRT.

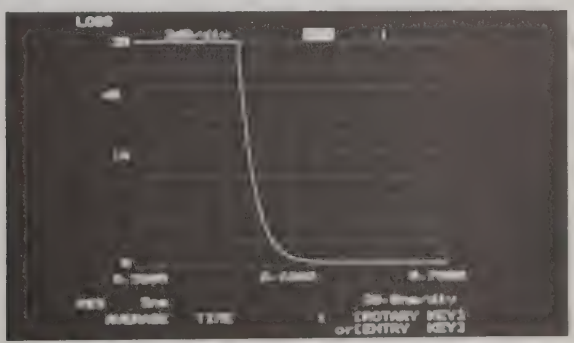
- **Deduction processing function**
  Two wavelength characteristics are deducted and the result displayed on the CRT. This function is indispensable for the measurement of wavelength loss characteristics.



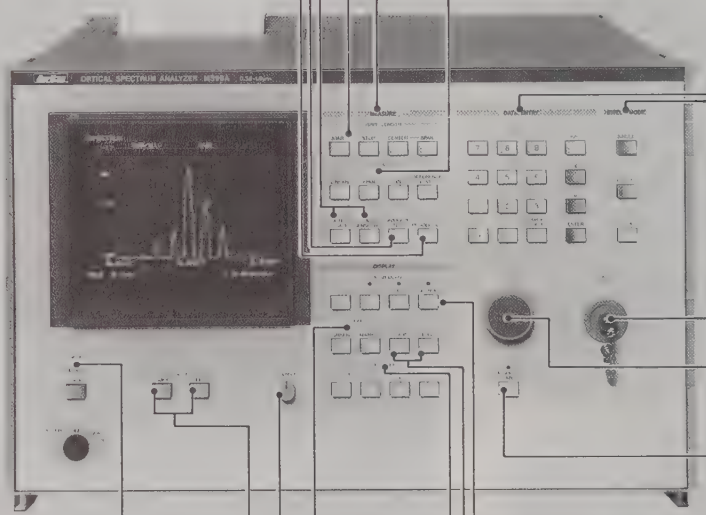
Curve-A (White light source)



Curve-B (White light + Filter)



(Curve-A)-(Curve-B) Wavelength loss characteristics of a filter



Auto Scale/High Sensitivity
The former is a switch for auto-ranging and the latter for setting the appropriate range.

Averaging
This sets the time for the averaging function.

Resolution
Sets bandwidth from 0.1 to 5nm.

GP-IB
Remote/Local
This switch is set to REMOTE when external control such as a computer is being employed, otherwise it is set to LOCAL.

Print—Copy, Feed
These switches control the feed of recording paper and the hard copy of the CRT by the internal printer

Intensity Control
Adjusts the intensity of the CRT.

Clear
Clears the display shown on the CRT.

Measurement Condition Setting

Wavelength Setting
These keys set the start and end of the wavelength as well as the center of the wavelength and the span of the wavelength sweep.

Measurement Level Setting
These keys set the measurement ranges on the CRT between LINEAR/EXPAND and LOG/REFERENCE LEVEL.

Data Entry
These keys are used when data is to be entered.

Sweep Mode
These keys are used for selecting between single sweep and repetitive sweep modes.

Optical Input Connector

Encoder
This is used for inputting data or changing measurement conditions.

Marker (coarse)
Coarse adjustment for the markers.

Data Memory
This key is used to select a memory out of four memories No. 1 to 4.

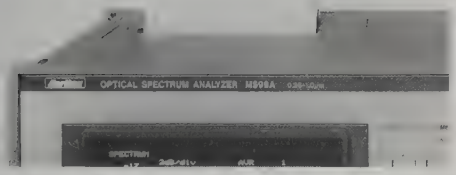
Deduction Processing
These are used for processing MES—RER (TRANS) and REF—MES (LOSS).

Marker
These are for displaying or setting the wavelength markers (2), and the level markers (2).

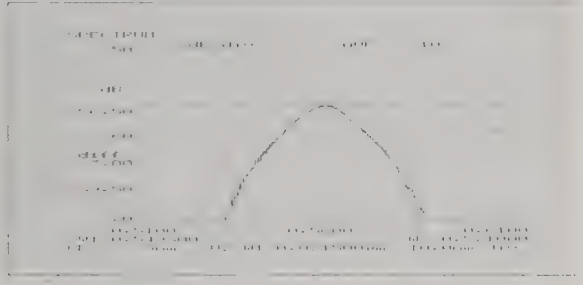
Internal Printer and GP-IB

● **Internal thermal printer**

Hard copies of the CRT display can be made through the use of the internal printer of the MS99A.



Print out example: LED (Green) Spectrum (via a fiber with 600μm diameter)



● **GP-IB**

It is possible to configure an automatic measuring system if interfaced with a personal computer.

Specifications

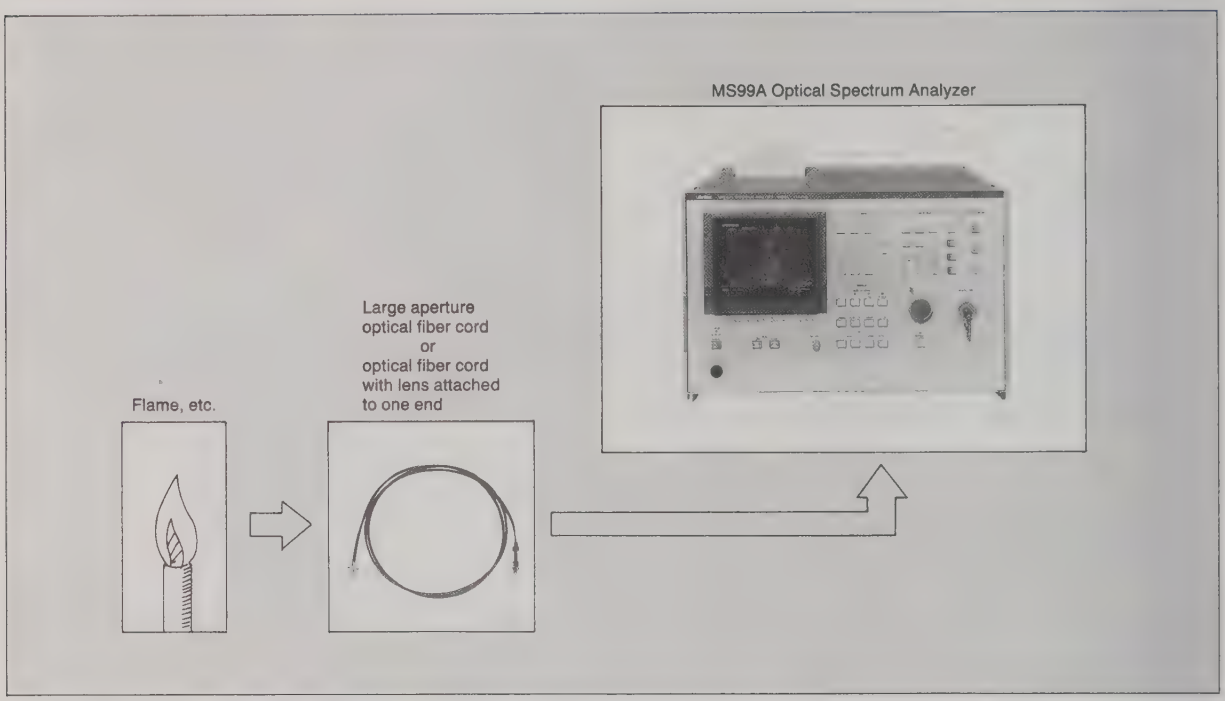
● **MS99A**

Wavelength range	0.35 to 1.1μm
Level measuring range	0 to −55dBm (0.35 to 1.1μm) } with a resolution ranging from 0.5 to 5nm 0 to −60dBm (0.45 to 1.0μm) } (level of power extracted with each resolution*3)
Level display range	Linear and 1, 2, 5/dB/div.
Wavelength accuracy	±1nm
Wavelength sweep width	0 to 100nm/div.
Resolution bandwidth	0.1 to 5nm*4
Data deduction processing function	Provided
Averaging function	Provided
CRT	7.5 inches electro-magnetic deflection type
Optical connector	FC*1
Video output	Composite video signal Approx. 1Vp-p at 75Ω load, Connector: BNC
Power	AC100V*2 ±10%, ≦200VA
Ambient temperature, rated range of use	10°C to 40°C
Dimensions and weight	426W, 266H, 415Dmm, ≦35kg

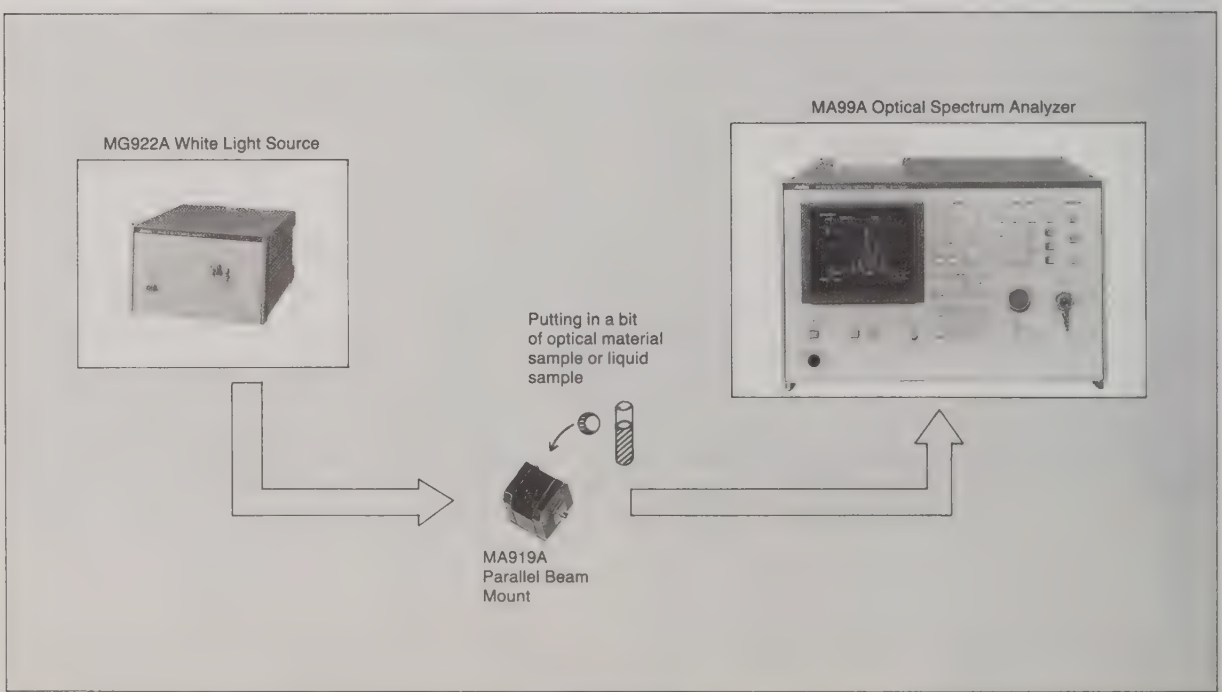
*1 The standard model provides the FC type.
One of DR, OF2, CN1102, TOCP18, etc. is available on request.
*2 Specify one nominal AC line voltage between 100V and 250V when ordering.
*3 Levels of optical power contained in the resolution band.
*4 Maximum resolution varies according to the diameter of fiber being used.

Application Example

- Burning state monitoring



- Transmittance observation on optical materials or liquid samples



Ordering Information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MS99A	Optical Spectrum Analyzer		
	Standard accessories		
J0008	GP-IB cable, 2 m:	1 pc	
J0200B	Optical fiber cord, 2 m:	1 pc	
J0017	Power cord, 2.5 m:	1 pc	
E0006	Keys for power switch:	2 pcs	
Z0007B	Printer paper:	2 rolls	
	Fuse for MS99A, 5 A:	2 pcs	MF51NN250V5AAC05
	MS99A Operation manual:	1 copy	
	Optional accessories		
MA918A	Light Emitting Element Measuring Unit		Composed of main unit and heads
MA919A	Parallel Beam Mount		
J0205	Large aperture optical fiber cord, 600 μm core dia.		SM-600FVD-95P
J0202	Large aperture optical fiber cord, 200 μm core dia.		SM-200FVD-95P
J0203	Optical fiber cord with lens attached to end, 50 μm core dia.		OPCL-5G100-FC-□ m
J0204	Optical fiber cord with lens attached to end, 200 μm core dia.		OPCL-5G100-FG-□ m
MP915A	Fiber Adaptor		For fibers with 0.3 to 1 mm jacket dia (125 μm clad dia.)
	Expendables		
Z0007B	Printer paper		2 roll/set
Z0063	Printer paper		2 roll/set dust-lens paper

Optical Spectrum Analyzer
MS9001A/MS9001A1

MS9001A

Features

- High-speed sweep: 0.3 second
- Wide dynamic range:
  50dB (MS9001A1)
  45dB (MS9001A)
- Ensuring level accuracy: ±2dB
- Ensuring linearity: ±0.5dB/10dB
- Wide level measurement range: +10 to −70dBm
- Wide wavelength measurement range: 0.6 to 1.75μm
- Various measurement condition settings and processing functions

Main Applications

- LD spectrum measurement
- LED spectrum measurement
- Optical fiber loss wavelength characteristic measurement
- Filter transmittance measurement

Description

The rapid development of optical communication systems and growing popularity of compact disks and video disks have promoted mass production of optical components such as LDs and LEDs.

Consequently, inspection measurement times during manufacturing must be shortened.

In addition, highly accurate spectrum measurements are required to develop and produce component parts (such as the DFB laser diode) for long-distance communications systems.

The MS9001A/A1 answer both these needs. The MS9001A/A1 high-speed sweep and data processing functions significantly reduce inspection measurement times.

Also, the MS9001A is expanded dynamic range, level accuracy and linearity enable more accurate spectrum measurement. In particular, the MS9001A plays a powerful roll in measuring the DFB laser diode side-mode ratio.

The MS9001A1 has the same specifications as the MS9001A except that the dynamic range is wider.

Both the MS9001A and MS9001A1 are high-speed, highly accurate, multifunctional optical spectrum analyzers that have been significantly improved by incorporating Anritsu technology from the MS96A.

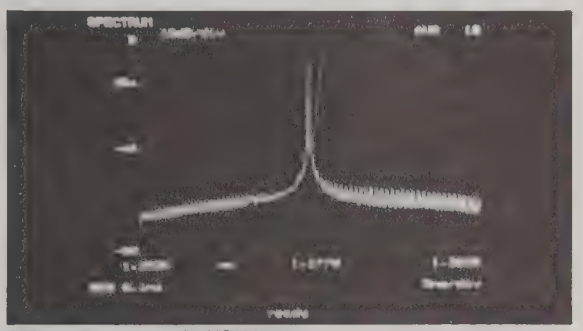
● **Up to 0.3-Second High-Speed Sweep**

The spectrum analyzers' processing time has been reduced by use of a high-speed sweep mechanism and also by use of a 16-bit CPU, so 0.3-second high-speed measurements at a sweep width of less than 2nm have become possible (only when sweep time set in FAST mode). In addition, 1-second high-speed measurements are possible at the 20nm, 50nm sweep widths used for multimode LD measurements.

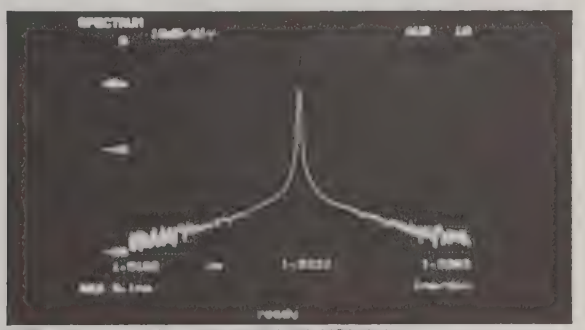
● **Wide Dynamic Range**

The MS9001A's 45dB dynamic range has been achieved by using a new type of diffraction grating in the optical section to minimize stray light.

The MS9001A1 uses a new type diffraction grating to give it a wider dynamic range of 50dB. This enables accurate measurement of the main and side-mode ratios of DFB laser diode.



DFB laser (measured with MS9001A1)



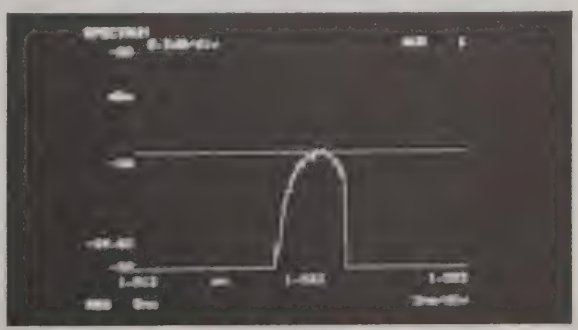
1.523μm He-Ne gas laser (measured with MS9001A1)

● **2dB Level Accuracy**

Because the MS9001A/A1 use a dispersion spectrophotometric method, the spectrum of LD can be measured with high accuracy.

These spectrum analyzers also use a newly developed light receiver section to measure light levels at a level accuracy of ±2dB (independent of light source polarization).

Consequently, the relative level differences of light-emitting elements can be measured. Stable measurement is possible even when the fiber is subjected to external vibration.

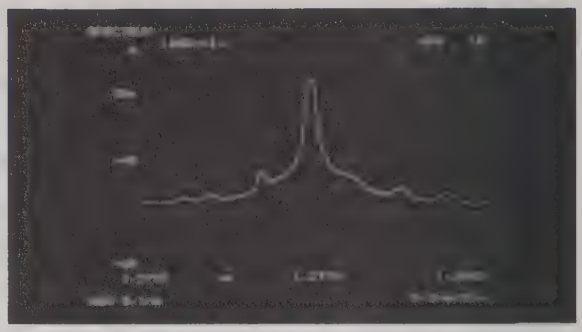


1.523μm He-Ne gas laser (SM fiber, −30dBm input)

● **±0.5dB/10dB Linearity**

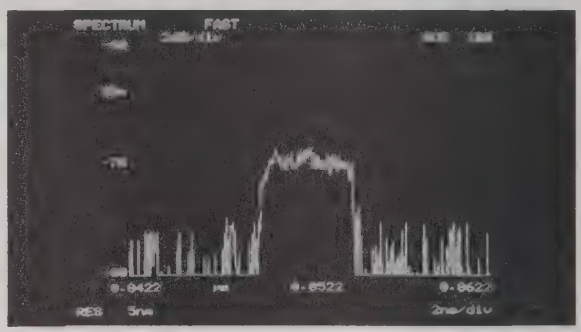
Because the MS9001A/A1 ensure level measurement linearity down to a minimum level of −70dBm, they can be used to accurately measure the interlongitudinal-mode level differences of semiconductor lasers.

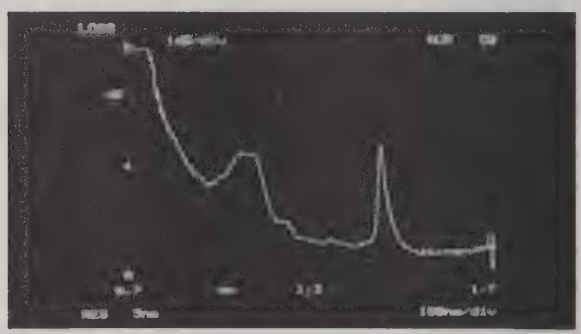
The photograph on the right shows a measurement example of two DFB lasers' light with a large level difference (levels: −10dBm, −45dBm) simultaneously input to the analyzer.



● **Wide Level Measurement Range (+10 to −70dBm)**

The MS9001A/A1 can measure low-levels of down to −70dBm because they use InGaAs-type pin photodiodes (for long wavelength band) and Si-pin photodiodes (for short wavelength band) as the light-receiving elements, and also use optical choppers. Therefore, loss-wavelength characteristics of an SM fiber can also be measured.

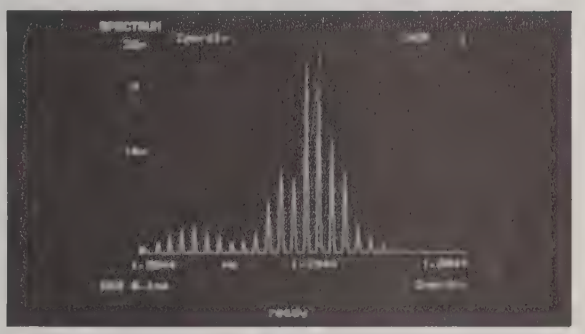




Functions

● Spectrum Auto Ranging Function

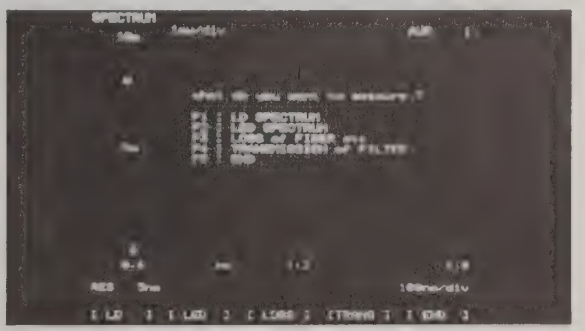
When the spectrum auto ranging key is pressed, this function repeats automatic measurements until the optimum measurement conditions are satisfied. The results are then displayed on the CRT.



● Conversational Measurement Condition Setting

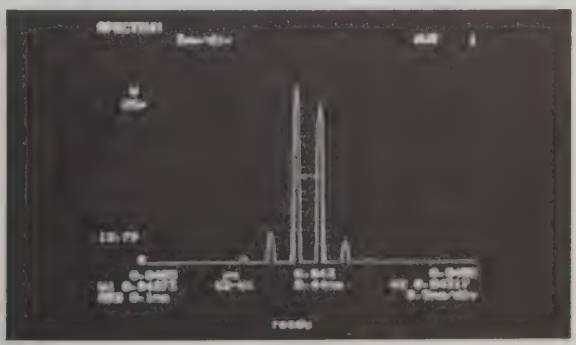
The MS9001A/A1 can measure interactively by setting measurement items and conditions using the sequential selections and messages displayed on the CRT menu. Possible conversational measurements are listed below.

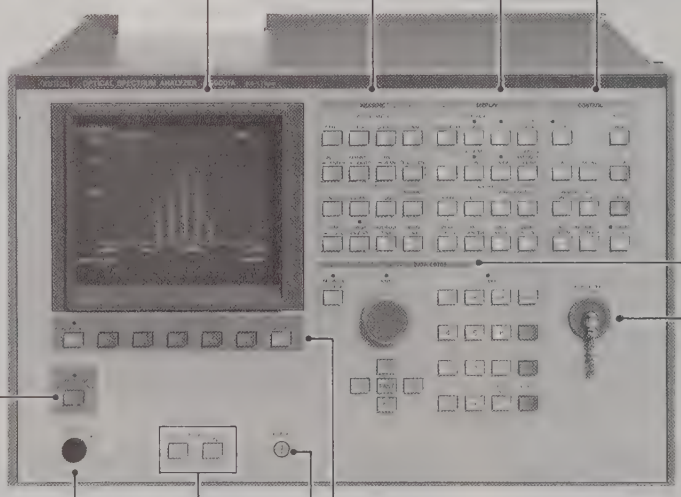
- Laser diode (LD) spectrum measurement
- Light-emitting diode (LED) spectrum measurement
- Fiber loss wavelength characteristic measurement
- Filter transmittance measurement



● Half-Width Automatic Reading Function

Marker indicates the spectral half width and the numeric value of the width is displayed on the CRT when the Half Width key is pressed.





CRT
The CRT displays measured waveform, scale, measurement conditions, and measurement results.

MEASURE
These keys set the wavelength, level, resolution, and other measurement conditions.

DISPLAY
These keys are related to the data and modes displayed on the CRT.

CONTROL
These keys set the sweep start and stop points, and transfer the measurement conditions to the memory.

DATA ENTRY
These keys are used together with the MEASURE, DISPLAY, and other keys, to set the measurement conditions' numeric values.

OPTICAL INPUT
This is the optical input connector.

POWER
This switch turns the power supply ON or OFF. When power is ON, the lamp on the right side is lit.

SOFT KEYS
These soft keys are used for interactive system measurements and in ADVANCED FUNCTION mode.

SPECTRUM AUTO RANGING
This key is used for automatic spectrum measurement. When it is pressed, the LED above the key lights until automatic measurement is completed.

INTENSITY
This knob adjusts the CRT brightness.

PRINT
These keys are used to hardcopy the CRT display at the built-in printer.

Specifications

Model	MS9001A	MS9001A1
Wavelength range	0.6 to 1.75μm	
Level measuring range*1	+10 to −70dBm (0.7 to 1.6μm) +10 to −65dBm (0.6 to 0.7μm) +10 to −55dBm (1.6 to 1.75μm)	
Measuring level accuracy*2	±2dB (at 0.85, 1.3, 1.55μm)	
Linearity	±3dB/60dB ±1dB/20dB ±0,5dB/10dB	
Level display range	0.2, 0.5, 1, 2, 5, 10dB/div and LINEAR	
Dynamic range (Stray light level)	≧35dB*3 ≧45dB*4	≧40dB*3 ≧50dB*5
Wavelength readout resolution	2pm	
Wavelength accuracy	±1nm (10° to 40°C), ±0.5nm (25°C)	
Resolution bandwidth	0.1, 0.2, 0.5, 1, 2, 5nm	
Wavelength sweep width	0, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100nm/div	
Sweep time*6	≦0.3s (Sweep width <2nm) ≦1s (Sweep width <50nm) ≦3s (Sweep width <500nm) ≦7s (Sweep width <1200nm)	
Processing function	Automatic setting for optimum measurement. Readout of half width of spectrum. Subtraction function. Averaging function. Memory backup. Peak search. Peak center. Wavelength calibration function.	
Data recording, etc.	Internal printer and GP-IB provided	
Dimensions and weight	266H×426W×450Dmm, ≦30kg	

*1 Levels per resolution bandwidth, excepting 0.1 and 0.2nm
*2 At −30dBm, resolution bandwidth 0.2 to 5nm, for SM fiber
*3 Level difference between a peak level measured at 1.1523μm or 1.523μm and a level read at ±1nm apart from peak wavelength with 0.1nm
resolution for SM fiber
*4 Level difference between a peak level measured at 1.1523μm or 1.523μm and a level read at ±10nm apart from peak wavelength with 0.1nm
resolution for SM fiber
*5 Level difference between a peak level measured at 1.1523μm or 1.523μm and a level read at ±5μm apart from peak wavelength with 0.1nm
resolution for SM fiber
*6 Averaging time: 1, measuring range: −30dBm (1μW)

Optional Accessories and Peripherals

● **Light Emitting Element Measuring Head (MA918A)**
This device is used for measuring spectral characteristics of optical elements not coupled to a connector. The element can be fixed in one simple operation, permitting immediate connection with optical fibers. Compatible heads are available for a variety of optical elements. (Photo A)

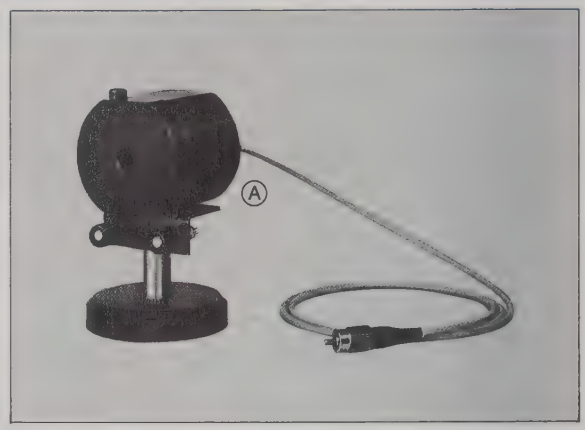
● **Parallel Beam Mount (MA919B)**
This is a unit which can connect the light emitted into free space as a parallel beam from an optical fiber cord to another optical fiber. This is used for measuring the wavelength loss of optical materials, etc. Contact us for more details. (Phono B)

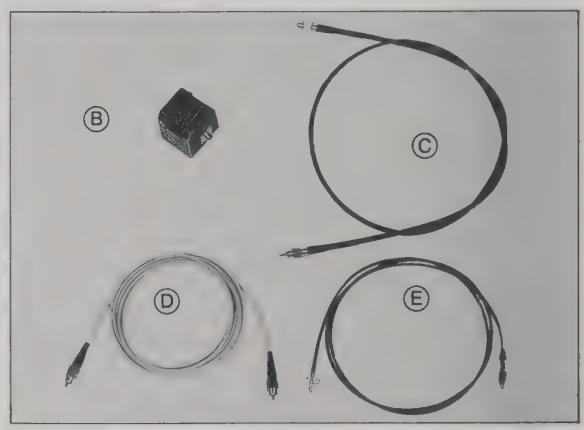
● **Optical Fiber Cord With Lens Attached to the End**
Recommended product: OPCU5G/00-FC-□m (Nippon Sheet Glass Co., Ltd.) (50/125m NA0.19 with FC plug, length □m) (Photo E)

Note: It can connect parallel beams to optical fiber with high efficiency.

● **Optical Fiber Cord**
(Photo D)

● **Large Aperture Optical Fiber Cord**
Recommended product: SM-600 FVD-95P (600/750μm NA0.2 with an FC compatible connector on both ends) (Photo C)





● **Wavelength Calibration Standard (MG9601A)**
The MG9601A is a standard wavelength generator used for optical spectrum analyzer wavelength calibration*.

Main Specifications
Light sources: Ar, Kr, Ne and Hg lamps
He-Ne gas laser (0.63282μm)
Wavelength accuracy: ±0.02mm
Spectrum level: ≧ −70dBm (when the attached optical fiber cord is connected)
Optical connector: FC type
Ambient temperature rated range of use: 23° ±5°C

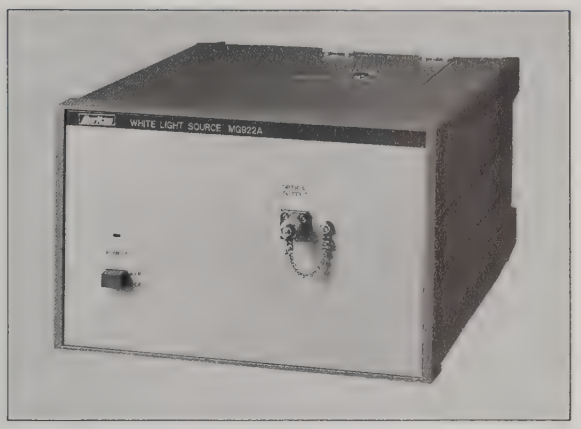
*Wavelength accuracy confirmation is made possible by using the MG9601A for the Optical Spectrum Analyzer MS9001A/A1, MS9002A or MS96A over their entire wavelength range. In particular, the MS9001A/A1 both have the WAVELENGTH CALIBRATION function which enables them to be calibrated to a spectrum of the MG9601A. Then, they can measure wavelength near the calibration point with very high accuracy.

● **White Light Source MG922A**

The MG922A is a wide-wavelength range light source that is indispensable for wavelength-to-loss and spectral transmittance characteristics measurement.

Element: Halogen lamp
Wavelength: 0.4 to 1.6μm
Output[*1]**:** −45dBm/5nm (0.7 to 1.6μm)
−55dBm/5nm (0.4 to 1.6μm)
Output stability[*2]**:** <0.3dB

[*1] When 2m of Anritsu multimode fiber (50/125μm, NA 0.2) connected
[*2] Stability within 10 minutes



● **Controller <Packet V Series PERSONAL TECHNICAL COMPUTER>**

This computer can be used as an external controller for the MS9001A/A1. It features:

- High-speed processing based on the high-performance 16-bit 68000 microprocessor
- FDOS based ANSI expanded BASIC
- Many interfaces

● **Portable Test Rack MB24A**

This portable test rack can be easily folded and carried to the application site. It features:

- 40kg maximum load capacity
- Horizontally fixed table angle
- Five AC outlets

● **Carrying case for MS9001A/A1**

This carrying case is convenient when transporting the MS9001A/A1 by car, plane etc.

Ordering Information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Mainframe		
MS9001A	Optical spectrum analyzer		
MS9001A1	Optical spectrum analyzer		
	Standard accessories		
J0008	GP-IB cable, 2m:	1 pc	
J0017	Power cord, 2.5m:	1 pc	
E0006	Power switch key:	2 pcs	
70007B	Printer paper:	2 rolls	
	Fuse for MS9001A/A1, 5A:	2 pcs	
	MS9001A/A1 operation manual:	1 copy	
	Optional accessories		
MA918A	Light Emitting Element Measuring Unit		Mainframe and head
MA919B	Parallel Beam Mount		
J0205	Large Aperture Optical Fiber Cord, 600μm Core Diam.		SM-600 FVD-95P
J0202	Large Aperture Optical Fiber Cord, 200μm Core Diam.		SM-200 FDV-95P
J0203	Optical Fiber Cord With Lens Attached to End, a 50μm Core Diam.		OPCL-5G/00-FC-□m
J0204	Optical Fiber Cord With Lens Attached to End, 200μm Core Diam.		OPCL-20G/00-FC-□m
MP915A	Fiber Adaptor		For 0.3 to 1.0μm jacket diam. (125μm clad diam.)
	Carrying case for MS9001A/A1		With casters
	Front cover		
	Key cover		
	Peripheral equipment		
MG922A	White Light Source		Light source for measuring loss wavelength characteristics
DDC7707A	Packet III PersonalTechnical Computer		
	Packet V Series Personal Technical Computer		
MB24A	Portable Test Rack		Horizontally fixed tilt angle type
	Consumables		
Z0007B	Printer paper		2 rolls/set
Z0063	Printer paper		Dustless paper: 2 rolls/set

Optical Spectrum Analyzer
MS9003A/MS9003B

MS9003A

《GP-IB》

Features

- Use of a Fabry-Perot interferemoter realizes 2.7 pm (picometers) wavelength resolution (MS9003B).
- Low ghost diffraction grating permits highly accurate measurements of DFB side modes.
- Wide range of measurement levels (0 to −30 dBm is high-resolution mode, 0 to −55 dBm in all other modes)
- MS9003B allows installation of two types of Fabry-Perot interferometers.
- Easy-to-use optical input connector eliminates troublesome axis adjustments.
- The finesse value, an indicator of the spectral resolution, is calculated and displayed, simplifying final alignment operations.

Description

The MS9003A/B optical spectrum analyzer boasts exceptionally high resolution achieved through use of a Fabry-Perot interferometer in a diffraction-grating spectrophotometer. The combination of a precision Fabry-Perot oscillator with a low ghost diffraction grating enables precise measrements of side modes in the output of DFB lasers and spectral spreading during high-speed laser modulation. The maximum resolution is 13 pm (10^{-12} m) for the MS9003A, and 2.7 pm for the MS9003B—well beyond the capabilities of conventional analyzers. The wavelength range is 1.2 to 1.6 μm.

Fabry-Perot Interferometers and their applications

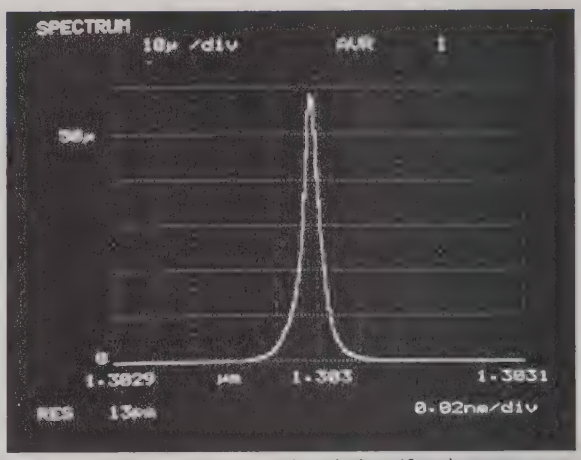
The Fabry-Perot interferometer used in the MS9003A/B is composed of two partially silvered mirrors (97.5% reflective at a wavelength range from 1.2 to 1.6 μm) and piezoelectric elements to vary the distance between the mirrors.
Thanks to the adoption of the Fabry-Perot interferometer, the MS9003A/B measures waveforms with very high resolution.
When monochrom incident light is applied to the interferometer, the distance of mirrors is integer multiplicatives of the applied light wavelength and an optical reasonance is caused by its multiple reflection.
By varying the distance of mirrors, the resonant wavelength can be varied. This is the principle of this instrument when measuring with high resolution.
In this way, a high wavelength resolution of 1 to 2 order higher is obtained than that of a grating system interferometer.
To obtain this high resolution the two mirrors must be placed exactly paralle. In this instrument, the parallelism can be adjusted electrically by using three knobs on the panel.

Alignment procedure

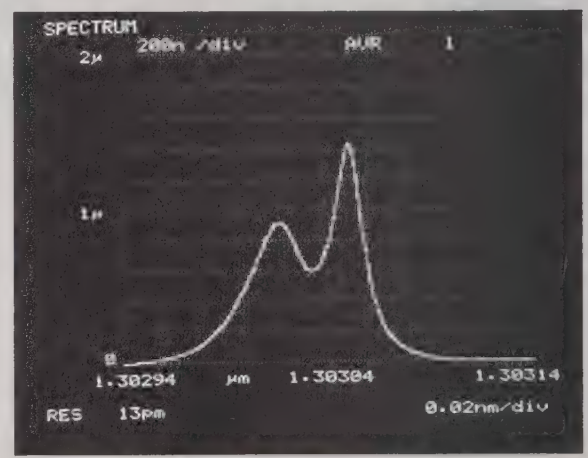
To achieve maximum resolution from the MS9003A/B, use the following procedure to perform a final mirror alignment before measurement.

1. Connect a narrow-band light source, such as a gas laser, to the optical input.
2. With the resolution at 0.1 to 0.2 nm, set the center wavelength and measurement level, and check that the spectral peak is centered on the screen.
3. Set the high-resolution mode.
4. Press the FINESSE key.
5. Adjust the three BIAS knobs until the finesse indicator at the bottom of the CRT reads 35.

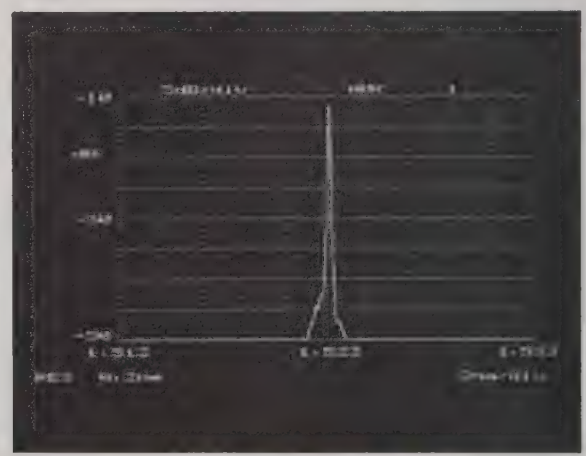
When this procedure has been completed, connect the light source for testing, set the wavelength and level, and begin taking measurements.



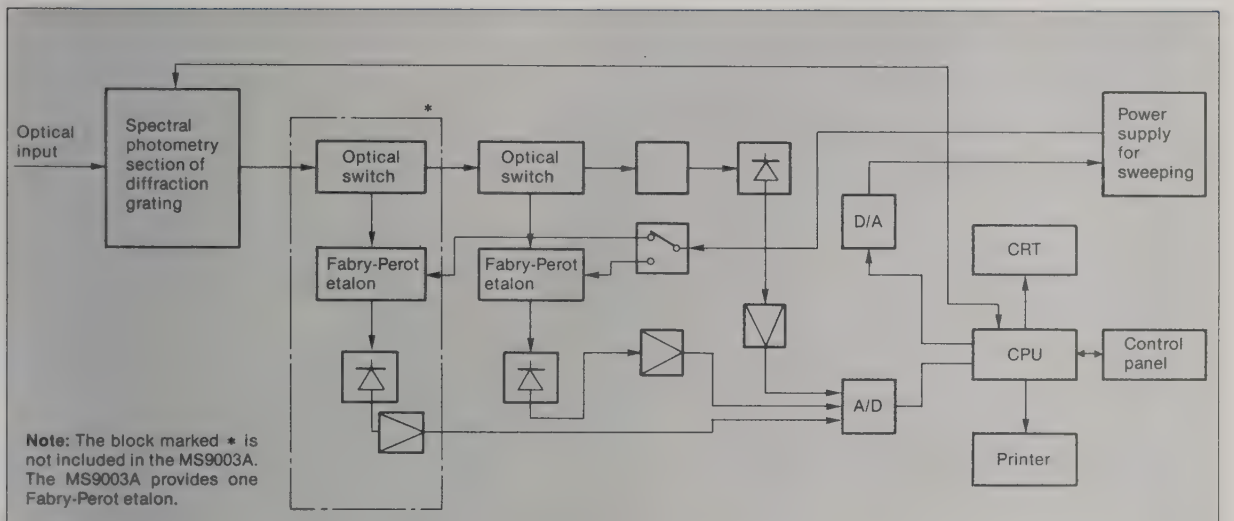
DFB laser spectrum (resolution: 13 pm)



Spectrum of DFB laser when modulated with high-speed signal of 2 GHz (resolution: 13 pm)



1.55 μm band gas laser spectrum (resolution: 0.2 nm)



MS9003B Optical Spectrum Analyzer block diagram

Specifications

Item	MS9003A	MS9003B
Wavelength range	1.2 to 1.6μm	
Level measuring rage	0 to −55dBm (bandwidth 5nm) 0 to −30dBm (high-resolution mode)	
Level display range	LINEAR and 1, 2, 5, 10dB/div	
Wavelength accuracy	±1nm (except high-resolution mode)	
Wavelength sweep width	0.2, 0.5, 1, 2, 5, 10, 20, 50nm/div 0.01, 0.02nm/div (at high-resolution measurement)	0.2, 0.5, 1, 2, 5, 10, 20, 50nm/div 0.005, 0.01, 0,02nm/div (at high-resolution measurement)
Resolution (bandwidth)	0.1, 0.2, 0.5, 1, 2, 5nm ≦13pm (at high-resolution measurement)	0.1, 0.2, 0.5, 1, 2, 5nm ≦2.7pm, ≦13pm (at high-resolution measurement)
Data deduction processing function	Provided (except at high-resolution measurement)	
Averaging function	Provided	
CRT	7.5 inches electro-magnetic deflection type	
Optical connector	FC type	
Video output	Composite video signal Approx. 1 Vp-p at 75Ω lead, connector: BNC	
Marker readout function	Provided	
Power	AC**V±10%, ≦200VA	
Dimensions and weight	Body 266H, 426W, 542D mm; approx. 35kg	
GP-IB	Conforms to IEEE-488 (24 poles)	
Thermal printer	Built in	
Ambient temperature, rated range of use	15 to 30°C	

** Specify one nominal line voltage between 100 V and 250 V when ordering.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MS9003A	Optical Spectrum Analyzer		
MS9003B	Optical Spectrum Analyzer		
	Standard accessories		
J0008	GP-IB cable, 2 m:	1 pc	
J0200B	Optical fiber cord, 2 m:	1 pc	With FC-type connector
	Connecting cord:	1 pc	
	Connecting cord:	2 pcs	
J0017	Power cord, 2.5 m:	1 pc	
E0006	Keys for power switch:	2 pcs	
Z0007B	Printer paper:	2 rolls	
	Fuse for MS9003A/B, 5 A:	2 pcs	MF51NN250V5AAC05
	MS9003A/B Operation manual:	1 copy	

Optical Time Domain Reflectometer
MW98A

《GP-IB》

Description

The MW98A main frame, with MH913B (0.85μm, GI), MH914C (1.3μm, GI), MH925B (1.3μm, SM) and MH929B (1.55μm, SM) plug-in-unit is a measuring instrument using the optical pulse method. It can measure the positions of faults, optical loss, splicing positions and losses in optical fibers. These are measured by launching an optical pulse into one end of the optical fiber and detecting reflected pulses and back-scattered light returning to the instrument. The measuring conditions, items and measured results are displayed on the CRT. A video printer output is also provided. The optical units are plug-in modules and, by exchanging the modules, measurements can be made at the 0.85μm (GI fiber), 1.3μm (GI fiber), 1.3μm (SM fiber) or 1.55μm (SM fiber) wavelength. Among the many outstanding features and functions provided are an easy-to-read CRT display, the capability for long-distance measurement and the measurement of various categories of losses, for processing to give high-speed averaging, and for "zooming" in (i.e., expansion) at any arbitrarily selected observation point. The MW98A is ideal for the full range of optical fiber applications, from research and development, through production, to installation and maintenance.

Features

- **Long distance measurement**
  72km distance range is provided
  MH913B: Measuring dynamic range over 22.5dB with one way back-scattered light (over 9km at 2.5dB/km fiber loss).
  MH914C: Measuring dynamic range over 20dB with one way back-scattered light (over 20km at 1dB/km fiber loss: 2μs pulse width).
  MH925B: Measuring dynamic range over 16dB with one way back-scattered light (over 32km at 0.5dB/km fiber loss: 2μs pulse width).
  MH929B: Measuring dynamic range over 14dB with one way back-scattered light (over 46km at 0.3dB/km fiber loss: 2μs pulse width).
- **High resolution**
  In the 18km, 36km and 72km ranges, the smallest resolvable distance on the read-out is 1m.
  For example, it is made possible to observe a distant point 72km away by setting and operating the controls as follows.
  Set the distance range to "72km," horizontal scale to one of "25m/div," "50m/div" and "100m/div," and then operate the SHIFT key appropriately to find the point to be observed.
- **Measurement of various losses**
  Simple pushbutton operation allows the splicing losses, losses of arbitrary length and losses per unit length (dB/km) to be measured by linear approximation using the two-point or least squares method.

- **High-speed averaging**
  Optical losses can be measured with a good signal-to-noise ratio in a short time. The averaging time is 0.4s for 30dB improvement when "AVERAGE OFF" is selected. When "AVERAGE ON" is selected the S/N ratio is further improved by exponential averaging.
- **Optical masking (0.85μm GI/1.3μm GI/1.3μm SM/1.55μm SM)**
  To eliminate the saturation, caused by strong nearby Fresnel reflection, the MH913B, MH914C, MH925B and MH929B use the optical masking technique. Optical losses in the vicinity of the point of reflection can be accurately measured.
- **Easy-to-read display of data on CRT**
  As well as the scales and monitored waveforms, the measuring conditions (sweep width, pulse with, etc.), the measuring items (loss, etc.) and the measured results are all displayed on the CRT.
- **Expansion of arbitrary observation range**
  The shift function allows the desired observation range to be expanded for closer checking.
- **Plug-in units**
  The optical units are plug-in units and by changing them, it is possible to perform measurements on 0.85μm, 1.3μm or 1.55μm wavelengths.
- **Video output for recording**
  The provision of a video output enables a video (graphic) plotter to be connected for high-speed hard copy.
- **GP-IB**
  Since a GP-IB interface is supplied, measurement can be automated by connecting the MW98A to Packet III personal Technical Computer.

Configuration

The MW98A offers four types of optical plug-in units for different wavelengths and types of optical fibers. The MW98A Main Frame can be combined with any of these units, permitting a broad variety of measurement applications. The following table shows a list of permissible combinations.

Model	Optical fiber wavelength and type			
	0.85μm (Multi-mode)	1.3μm (Multi-mode)	1.3μm (Single-mode)	1.55μm (Single-mode)
MW98A (Main frame)	●	●	●	●
MH913B (Plug-in unit)	●			
MH914C (Plug-in unit)		●		
MH925B (Plug-in unit)			●	
MH929B (Plug-in unit)				●

Applications

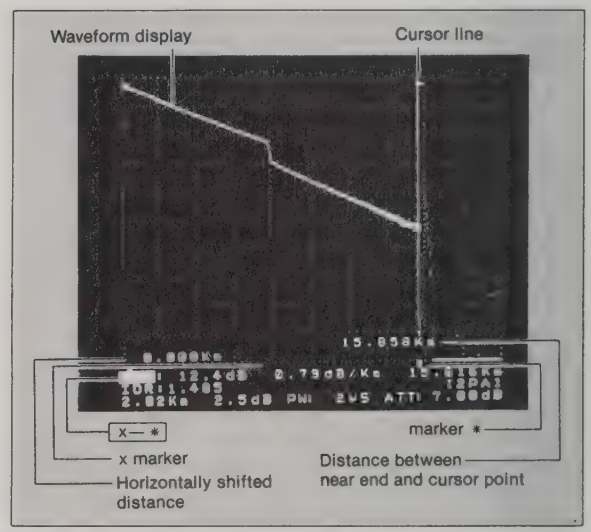
Field of use

- Optical fiber cable manufacture
- Optical fiber cable installation
- Maintenance and repair of optical fiber transmission lines
- Development and evaluation of optical fibers and optical parts

Measuring item

- Measurement of fault position
- Measurement (and evaluation) of losses in connector connections and splicing
- Measurement of optical losses
- Measurement of losses per unit length
- Measurement of insertion losses in various passive optical parts

- **Easy-to-read CRT display**
  The green CRT screen is easy on the eyes. The trace area is large and scales are displayed so that data may be easily read out.
  All the measurement parameters and selected functions are displayed on the screen.



x—* :	12.4dB	Loss between * and x marker
	0.79dB/km	Loss per unit length between * and x marker
	15.616km	Distance between * and x marker
IOR: 1.485		Index of refraction
[2PA] or [LSA]		The method of linear approximation [2PA]: Two points approximation [LSA]: Least squares approximation
2.02km		X axis: km/div
2.5dB		Y axis: dB/div
PW: 2μs		The pulse width setting
ATT: 7.00dB		Total attenuation setting

MARKER
• CURSOR SELECT
This key sets the vertical cursor on the marker to be moved on the CRT (up to five markers can be displayed).

• SHIFT
This key moves the markers selected by the CURSOR SELECT key.

• INITIALIZE
This key resets all markers to their standard positions which correspond to the selected pulse width.

DISTANCE RANGE
This key selects the range according to the length of optical fiber cable to be tested. The range can be set from 72 km, 36 km and 18 km in order. The lamp for the selected range lights.

PULSE WIDTH
This key selects the optical pulse width.

FUNCTION
This key selects either the measuring connection losses (SPLICE) or the measuring losses of between any two points and of dB/km (LOSS).

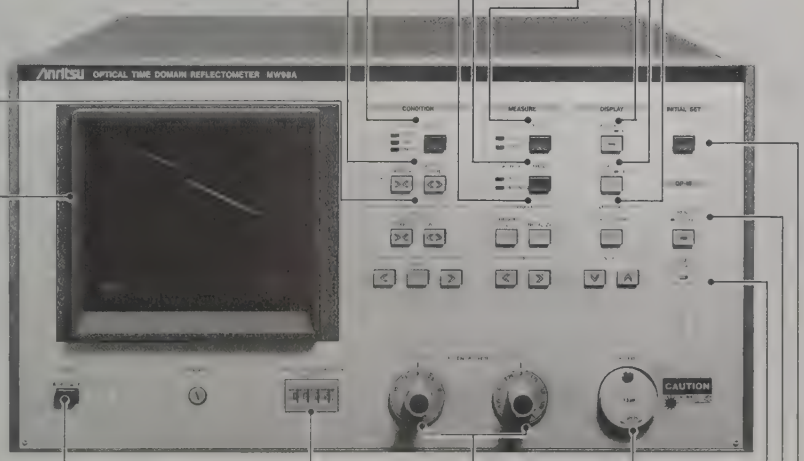
APPROX METHOD
This key selects the LSA (least square approximation) or 2 POINTS (approximation using the two specified markers) method for approximating the "SPLICE" or "LOSS" values as selected by the "FUNCTION" key. Pressing this key, the lamp of either "LSA" or "2 POINTS" lights.

AVERAGE
Turning OFF this switch refreshes displayed waveforms. Turning ON this switch causes them to be averaged continuously.

HOLD
This switch stops the averaging process and stops data update of the waveform displayed on the CRT.

VERTICAL
• SCALE
This key sets the vertical axis displayed on the CRT. 2.5 dB/DIV, 1dB/DIV, 0.5 dB/DIV and 0.25 dB/DIV can be selected.

• SHIFT
This key moves the waveforms vertically on the CRT.



HORIZONTAL
• SCALE
The scale can be set from 25 m/DIV to 4 km/DIV by using the NARROW/WIDE key.

• SHIFT
The SHIFT key moves a displayed waveform over the CRT screen. This makes it possible to observe the far end of fiber.

CRT
The CRT displays the Fresnel reflection from optical fiber cable and its backscattered light, scale, test conditions, test results, markers and cursor. The green CRT is very easy on the eyes.

POWER SWITCH
This switch turns the power ON and OFF. The pilot lamp lights when the switch is ON.

INDEX OF REFRACTION
This is a sum-rotary switch which enters the index of refraction of the optical fiber cable to be tested. The setting range is from 1.400 to 1.599.

ATTENUATOR (dB)
The attenuator adjusts the pulse amplitude of waveforms on the CRT. These dials can control over a range from 0 to 17.25 dB.

INITIAL SET
This key sets all selection keys except the DISTANCE RANGE key to their maximum settings, sets the ON/OFF key to OFF, the Function key to SPLICE, the APPROX METHOD key to LSA, the cursor to its home position and disables the VERTICAL SHIFT key.

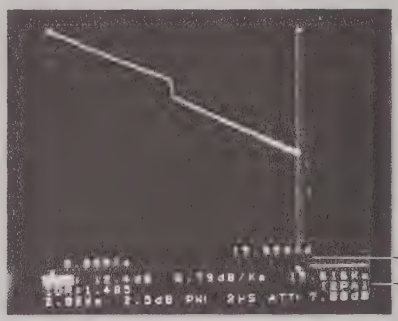
GP-IB
This lamp lights when the instrument is controlled externally.

LASER READY
Optical power is delivered from the output connector when the laser diode reaches its operating temperature and the lamp lights, after power switch is turned on.

OUTPUT
Output connector (FC type female) is provided on the inside of the protective cover.

● **Distance measurement**

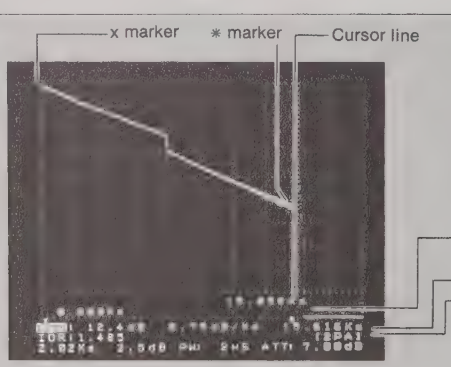
The distance from the end of the optical cable to the location marked by the cursor is numerically displayed.


Distance between the near end of the fiber being measured and the location marked by the cursor
Distance: 15.858km
Distance between x and ✳ marker

● **Faults in optical fibers, losses between two points**

After setting the "x" and the "✳" at arbitrary positions, the losses between those positions can be measured. Further, by simply moving the cursor to the point where all the light is reflected, the distance from the near end of the fiber being measured to the positions of faults can be read out.

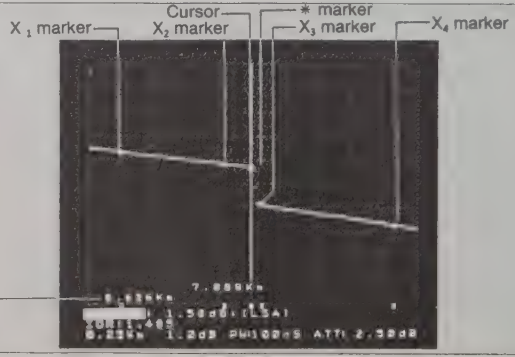
The MW98A employs linear approximation technique using least square method. Therefore, it permits precise measurement even on signals having poor S/N ratio.


x marker
✳ marker
Cursor line
Distance between the near end and the location marked by cursor
Distance between x marker and ✳ marker
Least squares approximation

Loss 12.4dB [Loss between ✳ and x marker]
0.79dB/km [Loss per unit length between ✳ and x marker]

● **Splicing losses**

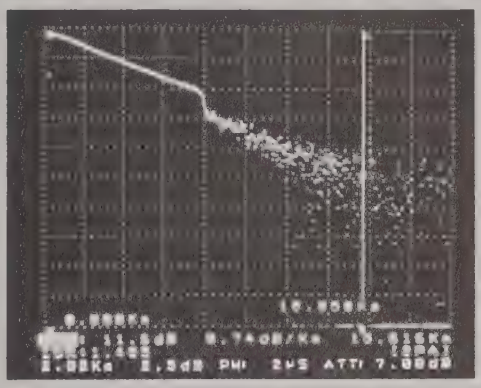
Move the "✳" to the location of the splice and push the INITIALIZE key. Four "x" are set at standard positions around the cursor; this avoids the trouble of setting the markers one-by-one.



● **High-speed averaging**

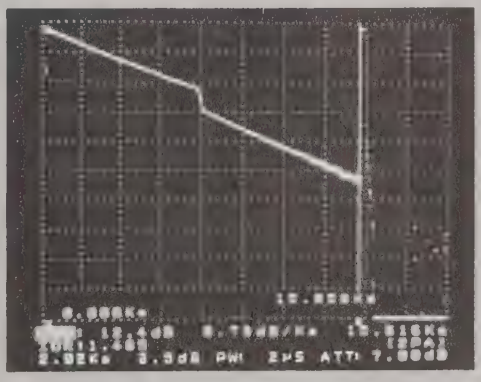
Since a 16-bit microprocessor enables high-speed averaging and high-speed processing, measurements can be performed rapidly.

If APPROX METHOD is set at 2 POINTS and the tester is in the AVERAGE OFF state, the displayed waveform will be frequently refreshed. This allows the quality of connections to be monitored during splicing operations.



Sample display in the AVERAGE OFF state
(1.3μm SM fiber cable)

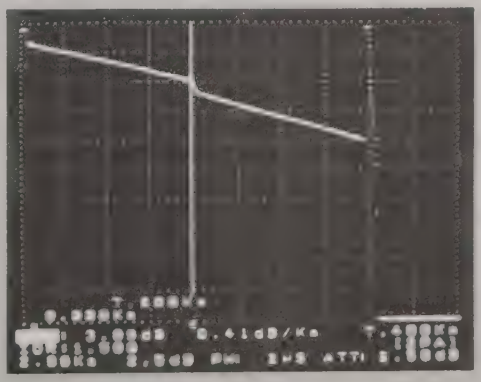
The display shown here occurred 10 minutes after AVERAGE ON was set. The S/N ratio has been improved so that the faults can be easily confirmed and their positions can be accurately judged.



Sample display in the AVERAGE ON state
(1.3μm SM fiber cable)

● **Loss measurement example in 1.55μm**

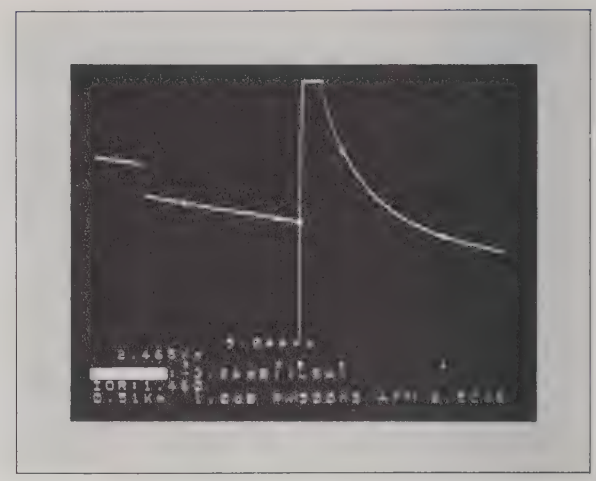
The display shown below is the measured result of loss in 1.55μm using the Plug-in Unit MH929B. Comparing to a display of loss measurement in 1.3μm (just upper side picture on this page), 1.55μm band loss curve appears declining slower.



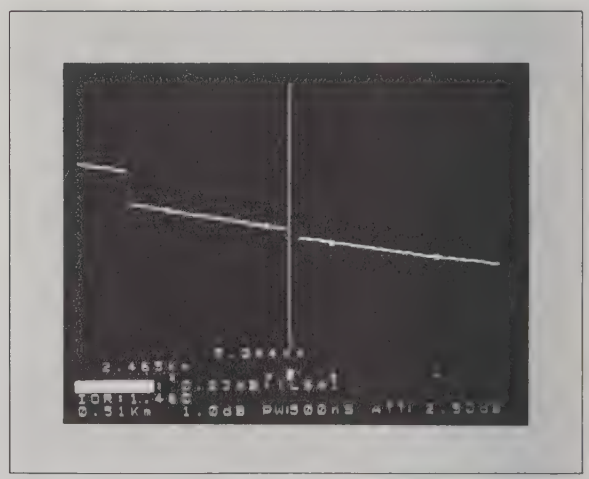
Sample display of loss in 1.55μm
(Measured on SM fiber cable)

● **Masking function**

Without a masking function, it is difficult to measure splicing loss or fiber loss just after a splicing point, because of a large pulse in the Fresnel reflection in the measuring method of optical time domain reflectometry. The masking function eliminates this problem, thus making measurement easy.



An example of splicing loss cannot be observed because of the Fresnel reflection.



An example of the masking function permitting easy measurement of splicing loss.

Specifications

● **MW98A**

Main frame	MW98A									
Plug-in unit	MH913B	MH914C			MH925B			MH929B		
Wavelength	0.85 ±0.02μm	1.30 ±0.02μm			1.30 ±0.02μm			1.55 ±0.02μm		
Fiber under measurement	GI				SM					
Optical output (Fiber input)	>10mW (50μm core/125μm clad)	>2mW (50μm core/125μm clad)			>1mW (10μm core/125μm clad)			>1mW (10μm core/125μm clad)		
Optical connector*1	FC type (GI)				FC type (SM)					
Mask function	Provided (Optical)	Provided (Optical)			Provided (Optical)			Provided (Optical)		
Pulse width	0.1μs	0.1μs	0.5μs	2μs	0.1μs	0.5μs	2μs	0.1μs	0.5μs	2μs
Dynamic range (One way back-scattered light level)	22.5dB	13.5dB	17dB	20dB	9.5dB	13dB	16dB	7.5dB	11dB	14dB
Distance range	18/36/72km									

Continued on next page.

Main frame		MW98A			
Plug-in unit		MH913B	MH914C	MH925B	MH929B
Horizontal	Scale (km/full scale)	0.25/0.5/1/2.5/5/10 (18km range) 0.25/0.5/1/2.5/5/10/20 (36km range) 0.25/0.5/1/2.5/5/10/20/40 (72km range)			
	Read-out resolution	1m (0.25/0.5/1km/full scale) 10m (2.5/5/10km/full scale) 20m (20km/full scale) 40m (40km/full scale)			
	Shift	0 to 18km (18km range) 0 to 36km (36km range) 0 to 72km (72km range)			
Vertical	Scale (dB/DIV)	0.25/0.5/1/2.5			
	Read-out resolution	0.01dB			
CRT display		8 inches GREEN			
GP-IB		IEEE-488 Interface function: SH1, AH1, T6, L4, SR1, RL1, PR0, DC1, DT1, C0			
Video output		Composite video signal 1Vp-p (75Ω load) Connector: BNC			
Power*2		100V ±10%, 50/60Hz ≦230VA			
Ambient temperature, rated range of use		0 to 40°C			
Dimensions and weight		221.5H, 426W, 451Dmm, ≦26kg			
Accessories supplied		One AC power cord			
		1 set of fuse			
		One instruction manual			
		FC fiber cord (2m) MH913B/914C GI, MH925B/MH929B SM			

*1 Advice is given to change different connector from FC.
*2 Line voltage is available any one of 100 to 108V/108 to 117V/117 to 127V or 200 to 216V/216 to 234V/234 to 254V AC.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MW98A	Optical Time Domain Reflectometer		
	Standard accessories		
J0226	Coaxial cord, 0.12 m:	1 pc	MP type
J0017	Power cord, 2.5 m:	1 pc	
B0115B	CRT hood:	1 pc	
B0021	Front cover:	1 pc	
	Fuse for MW98A, 5 A:	2 pcs	MF51NN250V5AAC05
	Fuse for MW98A, 3.15 A:	1 pc	MF51NN250V3.15AAC05
	MW98A Operation manual:	1 copy	
	Plug-in units		
MH913B	Plug-in Unit		For 0.85 μm band GI fiber
MH914C	Plug-in Unit		For 1.3 μm band GI fiber
MH925B	Plug-in Unit		For 1.3 μm band SM fiber
MH929B	Plug-in Unit		For 1.5 μm band SM fiber

Continued on next page.

(Continued)

Model number/ Order number	Name	Remarks
	Optional accessories	
J0007	GP-IB cable, 1 m	408JE-101
J0008	GP-IB cable, 2 m	408JE-102
	Carrying case for MW98A main frame	
	Carrying case for MW98A plug-in units	
	Soft case for MW98A main frame	
	Soft case for MW98A plug-in units	
	FC-A Adaptor	For GI fiber, FC connector
	FC-AS Adaptor	For SM fiber, FC connector
	OD-9480 Adaptor	For GI fiber, D4 connector
	OD-9484 Adaptor	For SM fiber, D4 connector
J0200A/B/C	Optical fiber cord, ∗m	FC-2-∗M-GI, For GI fiber
J0056A/B/C	Optical fiber cord, ∗m	FC-2-∗M-SM, For SM fiber
J0087A/B/C	FC to D4 conversion cord, ∗m	FC-D4-∗M-GI, For GI fiber
J0210A/B/C	FC to D4 conversion cord, ∗m	FC-D4-∗M-SM, For SM fiber
J0209A/B/C	FC to Runge conversion cord, ∗m	FC-RNG-∗M-GI, For GI fiber
J0208A/B/C	FC to Runge conversion cord, ∗m	FC-RNG-∗M-SM, For SM fiber
J0207A/B/C	FC to Diamond conversion cord, ∗m	FC-DIA-∗M-GI, For GI fiber
J0206A/B/C	FC to Diamond conversion cord, ∗m	FC-DIA-∗M-SM, For SM fiber
	Peripherals	
MP921B	Bare Fiber Connector	For GI fiber
MP922B	Bare Fiber Connector	For SM fiber
DDC7707A	Packet III Personal Technical Computer	
MB23A	Portable Test Rack	
G0002	M-085D Camera with #85-27 hood	
	UA455A Video Plotter	
	Expendables	
Z0047	Plotter paper for UA-455A	5 rolls/set

∗ Note: Optical fiber cord length and their order number.
Each type of optical cords listed above include three length types of 1m, 2m and 3m.
The last character of order numbe A, B or C corresponds each to 1m, 2m, or 3m.

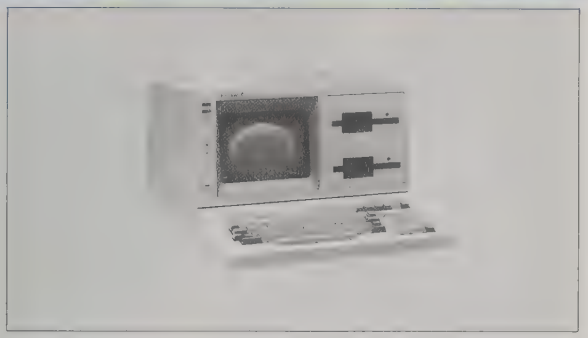
Optional accessories

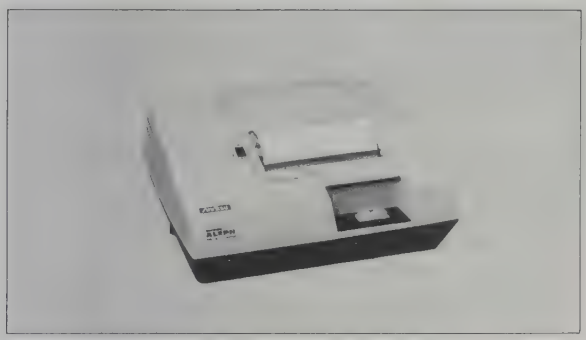
Controller

<Packet III Personal Techical Computer>

This computer can be used as an external controller for the MW98A.

- High-speed processing based on the high-performance 16-bit 68000 microprocessor
- FDOS based ANSI expanded BASIC
- Operating system has full interface capabilities and complete software support
- Special keyboard (optional) simplifies arithmetic control
- GP-IB controller function





Video Plotter

By using the UA-455A video plotter, hard copy of the CRT display can be easily obtained. The plotter is connected to the MW98A simply by means of a coaxial cable having BNC connectors.

Carrying case for MW98A

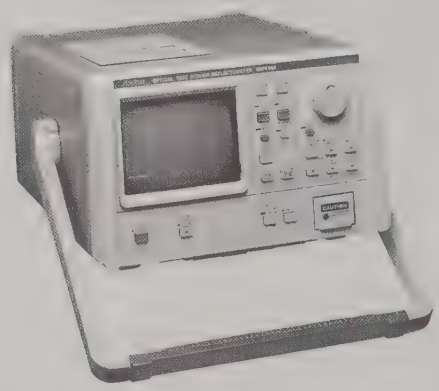
This carrying case is convenient when transporting the MW98A by car, plane, etc.

Portable Test Rack MB23A

This portable test rack can be easily folded and carried to the application site.

- 40kg maximum load capacity
- Variable table angle
- AC outlet

Optical Time Domain Reflectometer
MW910A



《GP-IB》
OPTION

Now there's an OTDR with all the features of a full-sized instrument—in a surprisingly compact and portable package. It's the Anritsu MW 910A. And it opens up a wealth of new possibilities for field service.

Pick up the MW910A and you'll appreciate its small size: in fact, it's probably smaller than your toolbox. It's light in weight, too—just 13 kilograms—so it goes where and when you do.

Even with all this portability, though, nothing has been sacrificed in terms of performance. In fact, the maximum measurement range is 144 kilometers, with a readout resolution down to just one meter. The wide dynamic range permits measurement of various types of losses, and the measured results are displayed digitally.

Another key feature of the MW910A is pushbutton switching between 1.31 and 1.55 μm in the MH955A/A1. Besides the MH955A/A1, which can be switched between 1.31 and 1.55 μm SM fiber measurement, other plug-ins include the MH937A/A1 (for 1.31 μm GI fibers), the MH938A/A1 (1.31 μm SM) and the MH939A/A1 (1.55 μm SM).

But that's just the beginning. The MW910A also offers three-point optical masking, a built-in printer, an option that allows operation with an external DC power supply, and much, much more.

No matter what area of fiber optics you're in—from research and development to manufacture to maintenance and service—you'll find the MW910A a big, big asset to your operations.

Features

Small in size, light in weight
With its small size (177 × 284 × 381 mm) and light weight (13 kg), the MW910A is ideal for the field. The convenient carrying handle does double duty as an inclined stand, too.

Long-distance measurement with 1-meter resolution
Maximum distance for measurement is 144 kilometers. The unit has a wide dynamic range, too, so breaks and other faults not causing Fresnel reflection can be detected even at these long distances. Moreover, measurement resolution is down to one meter throughout the distance range.

Switchable between 1.31 and 1.55 μm
The MH955A/A1 optical plug-in unit permits fast front-panel pushbutton switching between 1.31 μm and 1.55 μm.

Temperature-controlled laser diode light source
The laser diode light source is maintained at a constant temperature, so output power and wavelength are highly stable. This in turn virtually guarantees good repeatability of measured results.

3-point optical masking
All MW910A plug-in units offer optical masking of up to three points. Among other advantages, this means that Fresnel reflections occurring at positions close to each other can easily be attenuated, making loss measurement easier and more accurate than ever.

Easy operation
The MW910A provides many functions. Users can easily use this instrument by operating a rotary knob and a minimum number of keys.

Memory for measurement setup
Key settings are stored in memory (with battery backup) when power is turned off, and recalled automatically when power is reapplied. This feature makes the MW910A ideal for repetitive measurements.

Built-in thermal printer
Need a hard copy of measurement results? The MW910A gives it to you on the spot.

Built-in LED light source
(MH937A/MH938A/MH939A/MH955A type only)
The built-in LED light source permits diagnosis of the light receiving section, so troubleshooting is easy. And fiber loss measurements are easy using the light source and power meter.

External DC operation
Just add the optional MZ146A DC-AC inverter for operation using an external 12- or 24-volt DC supply (automobile battery, etc.).

GP-IB option
When the optional GP-IB interface is installed, the MW910A can be used with an external controller for automatic measurement or unattended monitoring.

Safe, too
Operators and technicians appreciate the safety interlock that prevents the emission of laser light unless a fiber is connected to the output connector and the LASER ON/OFF switch is ON.

Configuration

The MW910A offers eight different optical plug-in units for different wavelengths and types of optical fibers. By beginning with the MW910A Main Frame and adding the plug-ins necessary for your particular application, you can handle a wide variety of types of measurement in the most efficient manner possible. The following table shows the possible combinations:
(GP-IB interface is optional)

Model	Optical fiber wavelength and type					LED light source
	0.85μm Multimode	1.31μm Multimode	1.31μm Single-mode	1.55μm Single-mode	1.31μm/1.55μm Single-mode	
MW910A (Main frame)		○	○	○	○	
MH937A (Plug-in unit)		○				○
MH937A1 (Plug-in unit)		○				
MH938A (Plug-in unit)			○			○
MH938A1 (Plug-in unit)			○			
MH939A (Plug-in unit)				○		○
MH939A1 (Plug-in unit)				○		
MH955A (Plug-in unit)					○	○
MH955A1 (Plug-in unit)					○	
MH963A (Plug-in unit)	○					○
MH963A1 (Plug-in unit)	○					

CRT
Easy-on-the-eyes orange CRT displays the Fresnel reflection from the optical fiber cable, back-scattered light, scale, measuring conditions, results, makers, cursor position, etc.

SPLICE/LOSS
Used to select splice loss measurement (SPLICE); or optical loss between any two points (LOSS), indicated in dB/km.

LSA/2 POINTS
Used for SPLICE LOSS measurement, or LOSS measurement between two points. Selects measurement of the loss between the two specified points (2 POINTS) or use of least square approximation (LSA) for LOSS measurement. LSA is used for automatic measurement.

AUTO/MANUAL
Selects automatic (AUTO) or manual (MANUAL) marker setting at the time of SPLICE measurement.

AVERAGE
Set this switch to UPDATE for refreshing of the waveform displayed on the CRT, or to CONT for continuous averaging.

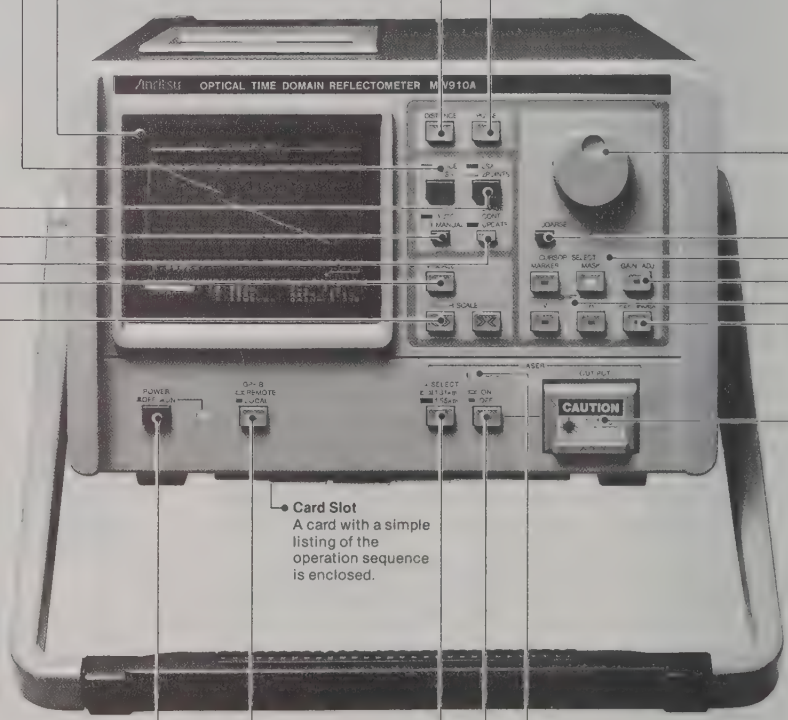
V-SCALE
Used to set the vertical axis scale; 4 dB/DIV, 2.5 dB/DIV, 1 dB/DIV or 0.5 dB/DIV can be selected.

H-SCALE
By depressing the ▷◁ or the ◁▷ key, the horizontal axis scale can be changed in the range from 25m/DIV to 8 km/DIV.

POWER
Lamp comes on when power switch is ON.

DISTANCE
Selects the range corresponding to the length of the optical fiber cable to be measured. Sequential switching of range (144 km, 72 km, 36 km, and 18 km) with each press of the key.

PULSE
For selection of the width of the optical pulse from the OUTPUT connector.



Card Slot
A card with a simple listing of the operation sequence is enclosed.

GP-IB
Illuminated to indicate instrument is under external control.

λ SELECT
For selection of the wavelength when the MH955A/A1 optical plug-in unit is used.

READY
Illuminated when the laser diode has reached the specified temperature range after POWER ON.

OUTPUT ON/OFF
ON/OFF control of the laser light emitted from the OUTPUT connector.

Rotary Control
Rotary control for coarse or fine adjustment of setting items; CURSOR SELECT, GAIN ADJ and SHIFT (V and H) REF INDEX.

COARSE
Enables rapid shifting of the cursor line by the rotary control during MASK setting.

CURSOR SELECT
MARKER
Sets cursor line onto the marker (× or ∗) displayed on the CRT, for moving the marker left or right with the rotary control.
MASK
Sets the cursor line onto the mask marker (up to three mask markers can be displayed) displayed on the CRT, for moving the marker left or right with the rotary control.

GAIN ADJ
For changing the amplitude of the CRT waveform with the rotary control.

SHIFT
V (VERTICAL)
For vertical movement of the CRT waveform using the rotary control.
H (HORIZONTAL)
For movement of the start point of the CRT waveform using the rotary control. Magnified display of any portion of the waveform is possible using this key and HORIZONTAL SCALE.

REF INDEX
Used with the rotary control for setting of the index of refraction of the optical fiber to be measured. Setting range is from 1.4000 to 1.5999 in steps of 0.0001.

OUTPUT
Adaptor (FC type is standard) for connecting the optical fiber to be measured. When no optical fiber cable is connected, safety interlock prevents emission of laser light.

LED OUT (NOTE)
Light source output terminal for checking light receiving section is provided on the inside of the cover.

ON/OFF (NOTE)
ON/OFF of output from LED OUT.

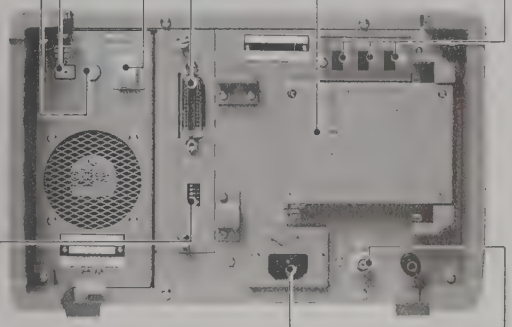
LEVEL ADJ (NOTE)
Controls output level from LED OUT

GP-IB (option)
External control can be executed via this connector. (Standard equipment is a blank panel.)

VOLTAGE SELECTOR
Three switches are set for desired AC line voltage according to the diagram.

Diagram

NOTE:
LED light sources are installed only in the A type plug-ins. (MH937A, MH938A MH939A, MH955A)



GP-IB Address Switches

Power Input Connector

VIDEO OUTPUT
Output terminal for external video plotter.

Printer Output

INTENSITY
For adjusting CRT trace intensity.

PRINT
Prints hard copy of the CRT screen.

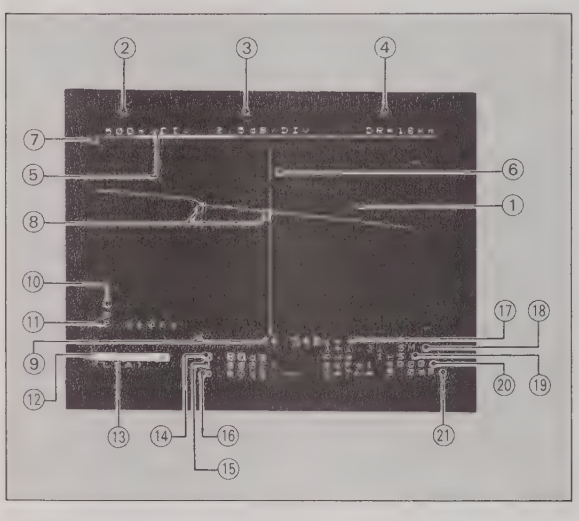
FEED
For paper feed on built-in printer.

Top View

Functions

● Easy to read CRT display

Measuring conditions and measured results are clearly labelled and assembled, making the MW910A a pleasure to use. The orange display is easy on the eyes, too. All the little "extras" have been looked after—for example, distance measurement is possible at all times, and the current distance from the output connector to the position corresponding to the cursor line is always on display beneath the cursor line.

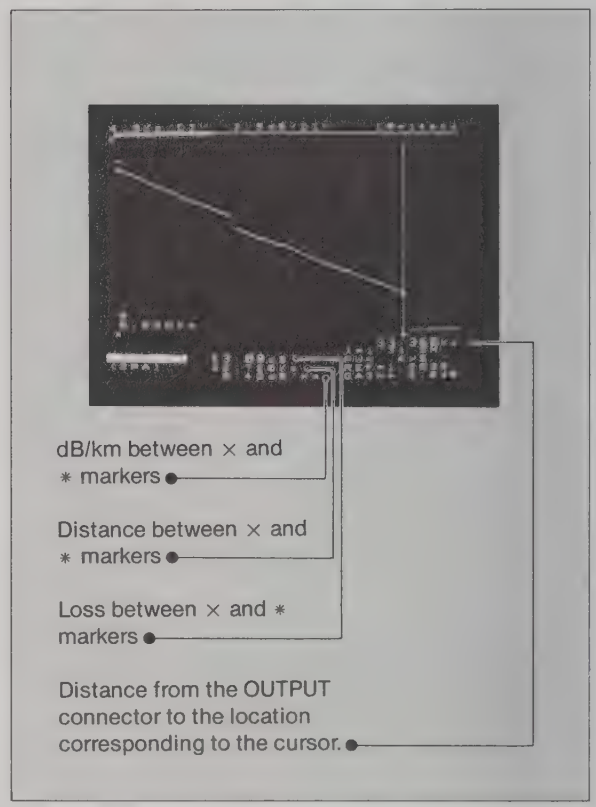


① Waveform trace
② H-SCALE
③ V-SCALE
④ Distance range
⑤ The range displayed for the DISTANCE ④ set value is indicated by a bold line
⑥ Cursor line
⑦ Mask marker
⑧ Markers on waveform trace
⑨ × and ∗ marker positions
⑩ V-SHIFT (+ or 0 for the initial value)
⑪ Horizontally shifted distance
⑫ Loss measurement display
(Indicates the loss between × and ∗ markers)
⑬ Linear approximation
(2PA): Two points approximation
(LSA): Least squares approximation
⑭ Loss between × and ∗ markers
⑮ Distance between × and ∗ markers
⑯ dB/km between × and ∗ markers
⑰ Distance from the OUTPUT connector to the location corresponding to the cursor
⑱ Wavelength used and fiber measured
⑲ Pulse width setting
⑳ Refractive index setting
㉑ GAIN ADJ setting

● Distance/loss measurement

The distance to the break or splice in an optical fiber is measured by simply setting the cursor line to point on the waveform where the break or splice is shown. Then read the numerical value displayed beneath the cursor line. Distance measurement can be performed in SPLICE mode as well as in LOSS mode.

In LOSS mode, the loss between any two points, the loss per unit length in dB/km, and the distance can be measured simultaneously; simply set the × marker to one point and the ∗ marker to another.


dB/km between × and ∗ markers
Distance between × and ∗ markers
Loss between × and ∗ markers
Distance from the OUTPUT connector to the location corresponding to the cursor.

● 1-meter readout resolution and magnification

To read with still higher accuracy, a readout resolution down to 1 meter can be obtained; just move the cursor line to the specified position and use the [α β] key to set the instrument to 25 m/DIV or 50 m/DIV. This selection is independent of the distance range, so you can use the horizontal shift function to measure with high resolution of 1 meter even at distances of 144 km.

Zooming display

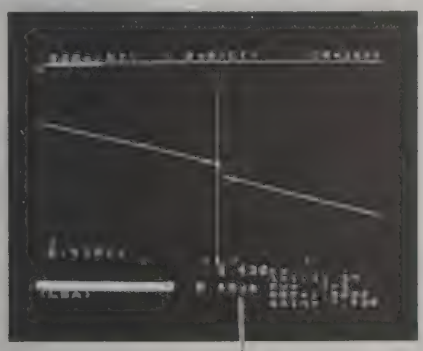
● AUTO splice loss measurement

This mode makes it possible to measure splice loss without having to set the four × markers individually. First set the ∗ marker to the splice point in MANUAL mode, then switch to AUTO; the four × markers are then automatically set to constant positions. A least squares approximation of the splice loss between the two × markers before the ∗ marker and the two × markers after the ∗ marker is then calculated and displayed.

Splice loss: 1.13 dB

● Splice loss measurement

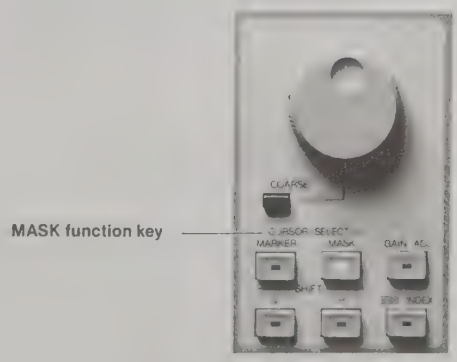
To measure splice loss, set the ∗ marker to the splice point on the CRT, then set the two markers onto the trace before and after the splice point.



Splice loss: 0.49 dB

● Optical masking

Without masking, it can be difficult to measure splice loss or fiber loss in the vicinity of a splice point because of the large Fresnel reflection pulse used in optical time domain reflectometry. Masking eliminates this problem, making measurement easier. You can set masks at three points on the MW910A CRT.



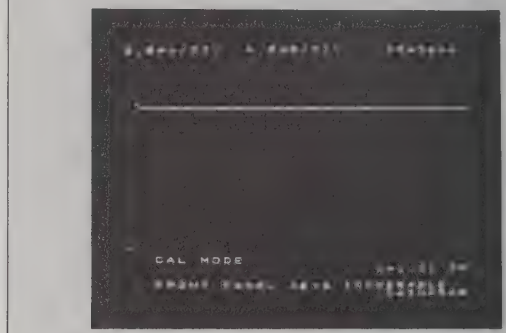
Without masking
Waveform distortion is caused after the Fresnel reflection, causing a significant error in splice loss measurement.

With optical masking
This function permits easy measurement of splice loss.

● **Self-check function (A type plug-ins only)**
A type plug-ins: MH937A, MH938A
MH939A, MH955A
As with all field equipment, fiber optic test gear is not immune to trouble; this can include decrease of output power due to dust or moisture, failure of measurement because of breaks near the instrument, etc. And invariably, these problems occur where there is no other test equipment available. In such cases, it is important to find out quickly whether the problem is caused by the measuring instrument itself or is in the fiber.

When used in conjunction with A type plug-ins, the MW910A, with its built-in LED light source, makes this determination more quickly and easily.

The LED output is connected to the OUTPUT connector on the front panel for display on the CRT, permitting self-diagnosis of the light receiving section of the MW910A. For the light emitting system, a power meter (such as the Anritsu Optical Handy Power Meter) can be used. When the LED OUT connector at the rear panel and the OUTPUT connector on the front panel are connected by the accessory measuring cable, and the LED ON/OFF switch is set to ON, the waveform on the MW910A should look like that shown in the figure below.



● **Simple fiber loss measurement (A type plug-ins only)**
Another scheme for optical fiber loss measurement is to use a power meter (for example, the Anritsu ML96B) in conjunction with the built-in LED light source of the MW910A. This setup is fast and easy, making it easy for optical fiber cable maintenance.

Specifications

Main frame		MW910A													
Plug-in unit		MH963A/A1			MH937A/A1			MH938A/A1			MH939A/A1			MH955A/A1	
Wavelength		0.85±0.02μm			1.31±0.02μm			1.31±0.02μm			1.55±0.02μm			1.31/1.55 ±0.02μm (switchable)	
Fiber under measurement		GI									SM				
Optical connector*1		FC type (GI)									FC type (SM)				
Mask function		Provided (Optical)													
Pulse width		0.1μs	0.5μs	2μs*2	0.1μs	0.5μs	2μs*2	0.1μs	1μs	4μs*2	0.1μs	1μs	4μs*2	0.1μs	1μs	4μs*2
Dynamic range (one way back-scattered light level)		17dB	20dB	23dB	15dB	19dB	22dB	12dB	17dB	20dB	10dB	15dB	18dB	10/8dB	15/13dB	18/16dB
Distance range		18/36/72/144km													
Hori-zontal axis	Scale (km/full scale)	0.25/0.5/1/2,5/5/10 (18km range) 0.25/0.5/1/2.5/5/10/20 (36km range)						0.25/0.5/1/2.5/5/10/20/40 (72km range) 0.25/0.5/1/2.5/5/10/20/40/80 (144km range)							
	Read-out resolution	1m (0.25/0.5km/full scale) 2m (1km/full scale) 10m (2.5/5km/full scale) 20m (10km/full scale)						40m (20km/full scale) 80m (40km/full scale) 160m (80km/full scale)							
	Shift	0 to 18km (18km range) 0 to 36km (36km range)						0 to 72km (72km range) 0 to 144km (144km range)							
	Accuracy	±3m ±measured value×2×10^{-5} without uncertain factors of fiber refraction index													
Vertical axis	Scale (dB/div)	0.5/1/2.5/4													
	Read-out resolution	0.01dB													
	Linearity	0 to 5dB: ±0.3dB, 0 to 10dB: ±0.5dB, 0 to 15dB: ±0.7dB													
CRT display		5.5 inches, ORANGE													
Thermal printer		Provided (0 to 50°C)													
Video output		Composite video signal: ≧1 Vp-p (75Ω load) Connector: BNC													
LED light source (A type plug-in units only)	Wavelength	0.85±0.03μm			1.31 ±0.03μm			1.31 ±0.03μm			1.55 ±0.03μm			1.31 ±0.03μm	
	Peak power	−40dBm (Typical)			−40dBm (Typical)			−40dBm (Typical)			−42dBm (Typical)			−40dBm (Typical)	
	Wavelength half width	≦150nm			≦150nm			≦150nm			≦230nm			≦150nm	
	Repetitional cycle	409.6μs													
	Duty cycle	50%													
	Waveform	Square wave													
Power		100V, 115V, 120V, 200V, 220V, 240V $^{+10\%}_{-15\%}$, 50/60Hz, ≦110VA													
Ambient temperature		0 to 40°C (Spec, meet), −15 to 55°C (Workable), −40 to 60°C (Storage)													
Dimensions and weight		177H, 284W, 381D mm, ≦13kg													
Accessories supplied		One power cord One set of fuses One optical fiber cord with FC connector*3: 2m One instruction manual Three rolls of printer paper One CRT hood One protective cover One service manual													
Laser products classification		21 CFR class 1													

*1 The optical connector of the standard model is FC. For other optical connector types, please consult nearest Anritsu representatives.
*2 2 μs or 4μs pulse width cannot be selected for 18 km range.
*3 One GI fiber cord is supplied with the MH937A, and one SM fiber with the MH938A, MH939A or MH955A as standard accessories.

Options and application equipment

GP-IB inteface	IEEE-488 Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0
DC/AC Inverter unit MZ146A	Input: DC 12 V/24 V ±15% Output: 125 Vo-p (400 Hz, square wave) Dimensions: 110 H, 146 W, 245 D mm Weight: <3 kg Accessories supplied: AC power cord, 2.5 m AC power cord, 0.3 m DC power cord, 2.5 m

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MW910A *	Optical Time Domain Reflectometer		
	Plug-in units		
MH963A	Plug-in unit		0.85 μm, GI fiber, with LED light source
MH937A	Plug-in unit		1.31 μm, GI fiber, with LED light source
MH938A	Plug-in unit		1.31 μm, SM fiber, with LED light source
MH939A	Plug-in unit		1.55 μm, SM fiber, with LED light source
MH955A	Plug-in unit		1.31/1.55 μm, SM fiber, with LED light source
MH963A1	Plug-in unit		0.85 μm, GI fiber, without LED light source
MH937A1	Plug-in unit		1.3 μm, GI fiber, without LED light source
MH938A1	Plug-in unit		1.3 μm, SM fiber without LED light source
MH939A1	Plug-in unit		1.55 μm, SM fiber without LED light source
MH955A1	Plug-in unit		1.31/1.55 μm, SM fiber without LED light source
	Standard accessories for MW910A		
J0344	Power cord, 2.5 m:	1 pc	
	Fuses for the MW910A, 3.15A (IEC fuse):	4 pcs	For 100 V mains
	Fuses for the MW910A, 1.6A (IEC fuse):	4 pcs	For 200 V mains
B0172	CRT hood:	1 pc	
B0173	Protective cover:	1 pc	
Z0080	Printer paper:	3 rolls	80 mm width, 26 m length/roll
	Operation manual:	1 copy	
	Service manual:	1 copy	
	Standard accessories for plug-in units		
J0200 B	Optical fiber cord with FC connector, 2 m:	1 pc	Supplied with MH937A/A1, MH955A/A1
J0056 B	Optical fiber cord with FC connector, 2 m:	1 pc	Supplied with MH938A/A1, MH939A/A1, MH955A/A1
B0174	Case for optical fiber cord:	1 pc	
	Plug-in unit service manual:	1 copy	
	Options		
MW910A-01	GP-IB Interface		IEEE-488
	Plug-in unit with D4 connector		One FC-D4 conversion cord is attached
	Plug-in unit with RUNGE connector		One FC-RUNGE conversion cord is attached
	Plug-in unit with DIAMOND connector		One FC-DIAMOND conversion cord is attached
	Plug-in unit with * * * connector		One FC-* * * conversion cord is attached

Continued on next page.

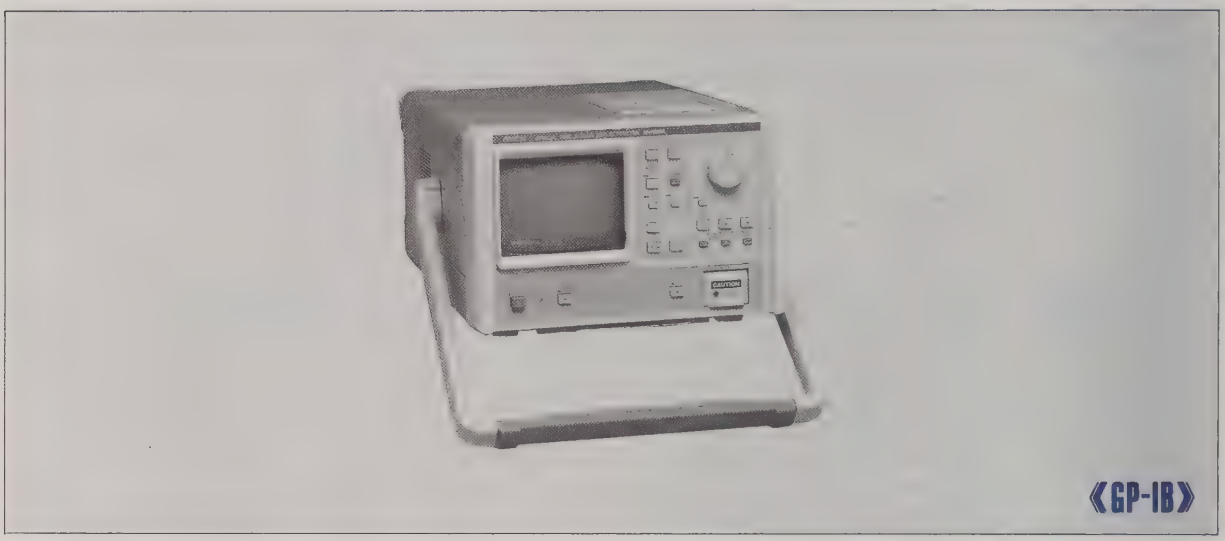
* * * Several connectors other than FC, D4, RUNGE and DIAMOND are available for plug-in units as options. Please consult the nearest Anritsu representative.

Model number/ Order number	Name		Remarks
	Optional accessories		
J0007	GP-IB cable, 1m		408JE-101
J0008	GP-IB cable, 2m		408JE-101
FC-A	Adaptor		For GI fiber
FC-B	Adaptor		For SM fiber
OD-9480	D4 Adaptor		For GI fiber
OD-9484	D4 Adaptor		For SM fiber
J0200 [A], [B], [C]	Optical fiber cord, ∗m		FC-Z-∗M-GI; for GI fiber
J0056 [A], [B], [C]	Optical fiber cord, ∗m		FC-Z-∗M-SM; for GM fiber
J0087 [A], [B], [C]	FC-D4 conversion cord, ∗m		FC-D4-∗M-GI; for GI fiber
J0210 [A], [B], [C]	FC-D4 conversion cord, ∗m		FC-D4-∗M-SM; for SM fiber
J0209 [A], [B], [C]	FC-RUNGE conversion cord, ∗m		FC-RNG-∗M-GI; for GI fiber
J0208 [A], [B], [C]	FC-RUNGE conversion cord, ∗m		FC-D4-∗M-SM; for SM fiber
J0207 [A], [B], [C]	FC-DIAMOND conversion cord, ∗m		FC-DIA-∗M-GI; for GI fiber
J0206 [A], [B], [C]	FC-DIAMOND conversion cord, ∗m		FC-DIA-∗M-GI; for SM fiber
B0175A	A type hard carrying case for MW910A		With caster
B0175B	B type hard carrying case for MW910A		With caster. Can store a packed MW910A in a soft carrying case.
B0176A	A type hard carrying case for plug-in unit		Without caster, can store one unit
B0176B	B type hard carrying case for plug-in unit		Without caster, can store two units
B0177	Carrying case for UA455A Video Plotter		
B0178	Soft carrying bag for MW910A		
B0179	Soft carrying bag for plug-in unit		
B0180	Waterproofed case for MW910A		
B0181	Carrying aid for MW910A		For carrying MW910A on one's back
	Peripherals I		
MZ146A	DC/AC Inverter		Switchable for DC 12V/24V input voltage
	Standard accessories for MZ146A		
J0345A	AC power cord, 2.5m:	1 pc	
J0345B	AC power cord, 0.3m:	1 pc	
J0346	DC power cord, 2.5m:	1 pc	
	Fuses for MZ146A, 10A:	2 pcs	For 12V DC input (MF51NN250V10ADC01)
	Fuses for MZ146A, 5A:	2 pcs	For 24V DC input (MF51NN250V5ADC01)
	MZ146A operation manual	1 copy	
	MZ146A service manual	1 copy	
	Peripherals II		
MP921B	Bare fiber connector		For GI fiber
MP922B	Bare fiber connector		For SM fiber
DDC7707A	PACKET III Personal Technical Computer		
DDC7708A	PACKET IIIs Personal Technical Computer		
G0015	M-085D Polaroid Camera with #85-23 hood		
UA455A	Video printer		Thermal printer. Supplied with one power cord and one BNC cable.
	Supplies		
Z0080	Thermal roll paper for printer		3 rolls/set (for MW910A internal printer)
Z0047	Plotter paper for UA455A		5 rolls/set
Z0077	Mini-floppy disk (2HD)		10 pc/set (for Packet III or IIIs)

∗ Nomencrature of optical fiber cord concerning their length:

1. Three lengths of 1m, 2m and 3m are standard.
2. These lengths are expressed by symbols A, B and C in order number, for example, J0200 [A], [B], or [C], where, A = 1m, B = 2m, C = 3m

Optical Time Domain Reflectometer
MW920A



The MW920A Optical Time Domain Reflectometer is designed for high-resolution distance measurements and for detecting fault positions in such medium- to short-distance optical fiber lines as optical subscriber lines, LANs, intra-office fiber channels of long-distance lines, and optical fiber cables used in automobiles, trains, aircraft, and ships.
A high resolution of down to 10 cm is provided with a very short dead zone (3 m for GI fiber and 8 m for SM fiber). In addition, this high-performance, mutlifunctional reflectometer is further enhanced by plug-in optical units, high-speed averaging processing capability, optical mask function (for SM fiber only), and the easy-to-operate ADVANCED FUNCTION. Despite these added features and functions, the unit size and weight have been reduced to enable reflectometer use in a variety of fields, from research/development and manufacturing of optical fiber cables to actual optical fiber line construction and maintenance.

Configuration

These different optical plug-in units for different wavelengths and type of optical fibers are available for use with the MW920A.

Model	Optical fiber		
	0.85μm Multimode	1.3μm Multimode	1.3μm Single mode
MW920A (Main frame)	○	○	○
MH951A (Plug-in unit)	○		
MH952A (Plug-in unit)		○	
MH958A (Plug-in unit)			○

Features

- **10-cm high resolution**
  When the distance range is set to 15 km, the unit can measure a distance of 15 km at a high resolution of 10 cm by using the shift function, regardless of the pulse width.

- **Short dead zone**
  The dead zone (from the near end) for a 3 ns pulse width is 3 m (MH951A/MH952A), while the MH958A has a dead zone of 8 m (from the near end).

- **High-speed averaging function**
  The unit processes averaging about five times faster than the ANRITSU MW910A. (Distance range: 15 km; resolution: 1 m)

- **ADVANCED FUNCTION**
  The ADVANCED FUNCTION includes the M.SAVE, M.RECALL, AVE HOLD COUNT, IOR, ATT, DATE, TITLE, and MASK (MH958A only) functions. These easy-to-operate functions can be used by operating only three keys and the rotary knob.

- **Waveform memory**
  Built-in memory with battery backup is provided to store up to five screens of measurement results and other information (key settings and waveform traces). A very convenient feature when comparing, evaluating, or recording traced waveforms.

- **Safeguard mechanism against laser light**
  The section to which fiber is connected for measurement has a safety interlock mechanism. This prevents laser diode activation until the OUTPUT connector cover is opened and the OUTPUT ON/OFF key is set on.

- **Optical mask function (MH958A)**
  The MH958A (for 1.3 μm, single-mode) plug-in unit has an optical mask function to mask one arbitrary point on the screen. This lets the user measure near Fresnel reflection.

- **Built-in GP-IB interface**
  Because a built-in GP-IB interface is provided, an external controller can be connected for automatic measurements.

- **Built-in thermal printer**
  Hard copies of CRT display information can easily be obtained by using the built-in thermal printer.

- **Memory for measurement setup**
  Key settings are retained in memory (with a battery backup) when the power is turned off, and are automatically recalled when the power is turned on again. This feature makes the MW920A ideally suited for repetitive measurements.

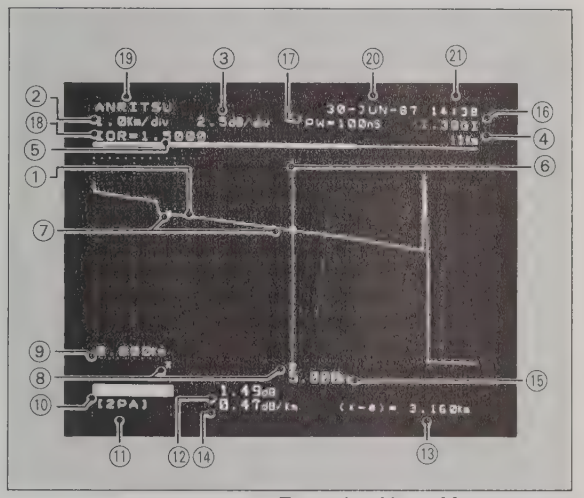
- **Compact, lightweight, and portable**
  The MW920A is compact (177H × 284W × 381D mm) and lightweight (13 kg).

  The carrying handle (also used as an inclined stand) makes the unit very easy to carry.

- **External DC operation**
  Connect the MZ146B DC-AC inverter (option) when using external DC power (12/24 V) such as an automobile battery and other sources.

Functions

- **Easy-to-Read CRT Display**
  The MW920A incorporates a green CRT screen that is easy on the eyes.
  Measuring conditions are displayed on the upper side of the screen while measurement results are displayed on the lower side of the screen to facilitate easy reading.



Example of Loss Measurement

① Waveform trace
② H-SCALE
③ V-SCALE
④ Distance range
⑤ The range displayed for the DISTANCE ④ set value and position are indicated by the solid lines.
⑥ Cursor line
⑦ Markers on waveform trace
⑧ X and ∗ marker positions
⑨ SHIFT-H
⑩ Indication of loss measurement mode
⑪ Linear approximation (2PA: Two points approximation)
⑫ Loss between X and ∗ markers
⑬ Distance between X and ∗ markers
⑭ dB/km between X and ∗ markers
⑮ Distance from the OUTPUT connector to the location corresponding to the cursor
⑯ Wavelength used and fiber measured
⑰ Pulse width setting
⑱ Refractive index setting
⑲ Title
⑳ Date
㉑ Time

CRT
Displays the Fresnel reflection from the optical fiber cable, back-scattered light, scale, measuring conditions, results, markers, and cursor position.

DISTANCE
Selects the range corresponding to the length of the optical fiber cable to be measured. Alternatively switches 40 km or 15 km range each time the key is pressed.

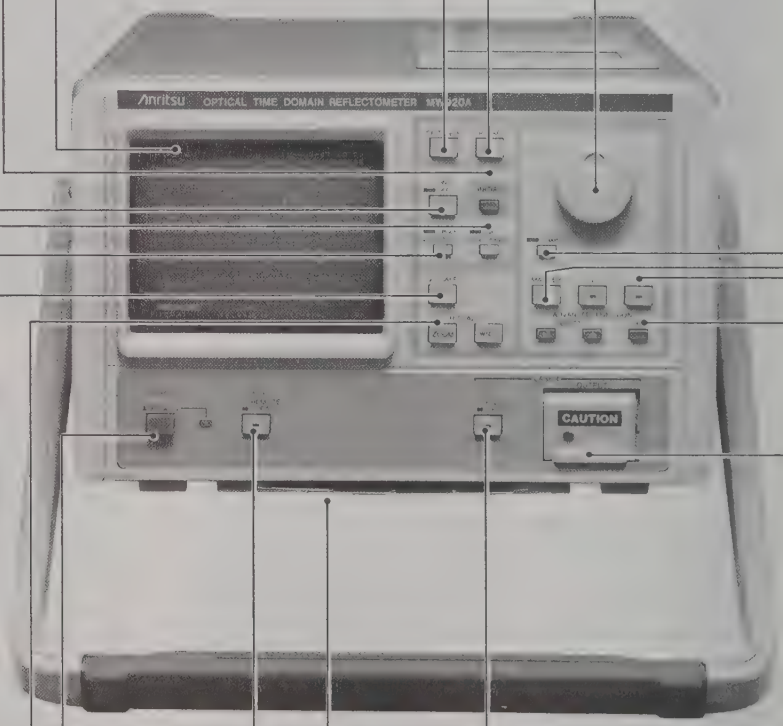
PULSE
This key selects the width of the optical pulse from the OUTPUT connector.
Sequentially sets 100 ns, 10 ns, and 3 ns for each pressing.

INITIAL
Initializes the measuring conditions. Sets the initial and previous measuring conditions each time the key is pressed.

AVERAGE ON/OFF
Set this switch to OFF to refresh the waveform displayed on the CRT, or set to ON for continuous averaging.

LSA/2 POINTS
Selects SPLICE Loss measurement or LOSS measurement between two points. Selects measurement of the loss between two specified points (2 POINTS) or use of least square approximation (LSA) for LOSS measurement.

SPLICE/LOSS
Selects the measurement of splice loss (SPLICE) or optical loss between any two points (LOSS); indicated in units of dB/km.



V-SCALE
Sets the vertical axis scale: 4 dB/DIV, 2.5 dB/DIV, 1 dB/DIV, or 0.5 dB/DIV can be selected.

H-SCALE
The horizontal axis scale on the CRT screen can be changed in the range from 5 m/DIV to 1.0 km/DIV by pressing the [ZOOM] or [WIDE] key.

POWER
Lamp comes on when power switch is ON.

OUTPUT ON/OFF
ON/OFF control of the laser light emitted from the OUTPUT connector.

CARD CASE (OPERATION GUIDES)
A card with a simple listing of the operation sequence is enclosed.

GP-IB
Lights to indicate that the unit is under external control.

Rotary Control
Used for coarse or fine adjustment of setting items; MARKER, SHIFT (V and H) and ADVANCED FUNCTION SET.

COARSE
The lamp comes on to indicate the speed of shifting. Displacement using the rotary control is increased ten times.

MARKER
Sets a cursor line onto the marker (X or *) displayed on the CRT to move the marker to the left or right using the rotary control.

SHIFT
V (VERTICAL)
Used for vertical movement of the CRT waveform using the rotary control.
H (HORIZONTAL)
Used for moving the start point of the CRT waveform using the rotary control. Enables any portion of the waveform to be magnified on the display when used with HORIZONTAL SCALE.

ADVANCED FUNCTION SELECT
Possible to select one of the ADVANCED FUNCTION by pressing the ▽ or △ key.
SET
Sets data for each ADVANCED FUNCTION or mode to be switched by using the rotary control in combination with this key.

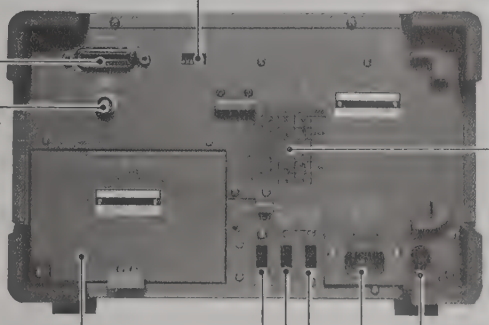
OUTPUT
An adaptor (standard FC type) for connecting the optical fiber to be measured is mounted on the inside of this lid. Safety interlock prevents the emission of laser light unless the lid (OUTPUT connector cover) is opened.

Voltage selection table
Use this table to set the VOLTAGE SELECTOR switches.

GP-IB
External control is possible via this connector.

GP-IB address switch

Rear panel



VIDEO OUTPUT
Output terminal for external video plotter.

Plug-in unit

GND
Ground terminal.

VOLTAGE SELECTOR
Three switches are set to the desired AC line voltage according to the diagram.

AC Inlet
Connector for power input.

Printer output

Top view

INTENSITY
Adjusts CRT trace intensity.

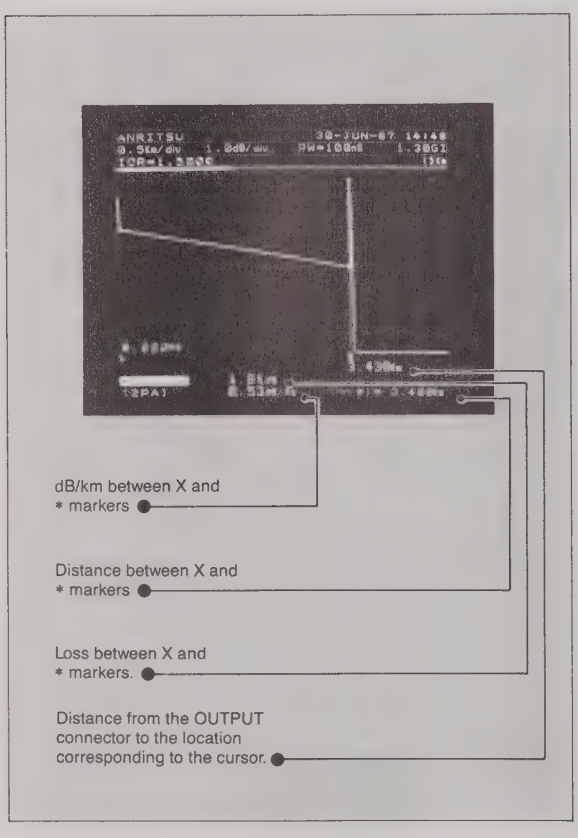
PRINT
Outputs a hard copy of the CRT screen from the built-in printer.

FEED
Feeds paper on the built-in printer.

● **Distance/Loss measurement**

The distance to the break or splice in an optical fiber is measured by simply setting the cursor line to the point on the waveform where the break or splice is indicated. Then read the numerical value displayed beneath the cursor line. Distance measurement can be done in the SPLICE mode or LOSS mode.

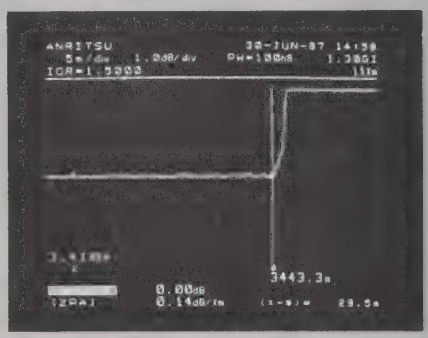
In the LOSS mode, the loss between any two points, the loss per unit length (dB/km), and the distance can be measured simultaneously; simply set the X marker to one point and the * marker to the other.


dB/km between X and * markers
Distance between X and * markers
Loss between X and * markers.
Distance from the OUTPUT connector to the location corresponding to the cursor.

● **10-cm readout resolution and magnification**

To read with even higher accuracy, a readout resolution down to 10 cm (0.1 m) can be obtained; simply move the cursor line to the specified position and use the [ZOOM] key to set the instrument to 5 m/DIV (for a distance range of 15 km only).

When the horizontal shift function is used with this function, the top resolution of 10 cm can be optained even at distances of 15 km.


Zooming display example

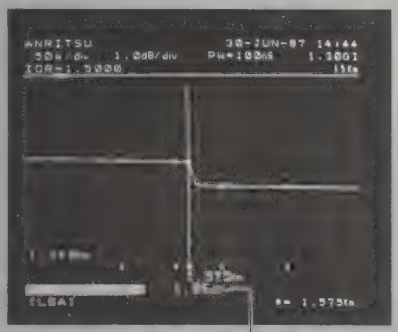
● **Dead zone (from near end): 3 m (MH951A/MH952A; at ambient temperatures from 20° to 30°C.**

When the optical pulse width is set to 3 ns, the dead zone of MH951A (0.85 μm GI)/MH952A (1.3 μm GI) is 3 m or less from the near end. When combined with the 10 cm readout resolution, this feature enables easy detection of any nearby fault locations.

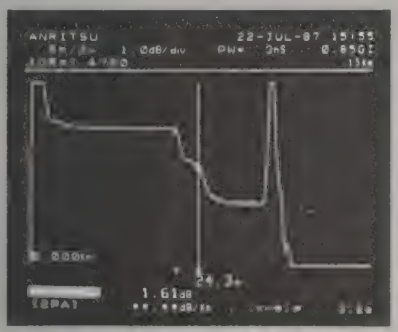
The MH958A (1.3 μm SM) has an 8 m dead zone.

Zooming display example of near end

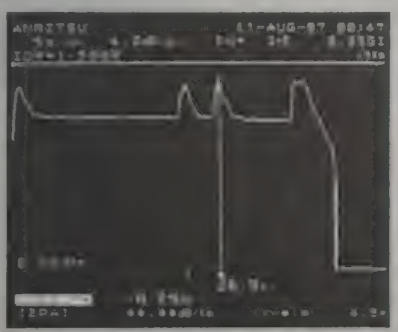
● **Splice loss measurement**
To measure splice loss, set the * marker to the splice point on the CRT. Then set the two markers onto the trace before and after the splice point.



● **Inter-point distance readout resolution**
This is the minimum distance between points that the instrument can distinguish when several connection or fault points are positioned close to each other.



Detection of connection points 2.3 m apart



Detection of connector positions 2.6 m apart

● **ADVANCED FUNCTION**
The multifunctional instrument features the ADVANCED FUNCTION, which includes the following seven functions (eight functions with the MH958A):

①M.SAVE
The waveform memory function stores up to five screens of display information: trace waveforms, measuring conditions, time, and titles.

②M. RECALL
This function displays the screen information (stored by the M.SAVE function) one screen at a time.

③AVE HOLD COUNT
With the AVERAGE switch set to ON, up to 4500 averaging processing operations can be set in steps of 100.

④IOR
Use this function to set the index of refraction.
The setting range is from 1.4000 to 1.5999 in steps of 0.0001.

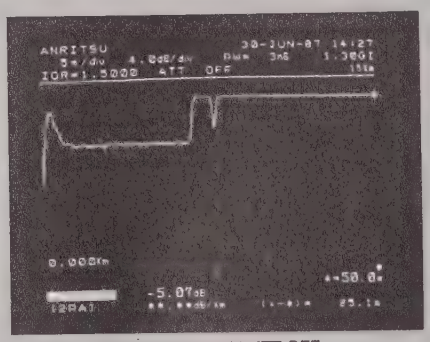
⑤ATT
The optical pulse output can be selected from two levels (four levels with the MH958A). For measurement near the connector end using a 3 ns optical pulse, set the ATT ON to attenuate the output and reduce the Fresnel reflection. This makes the two points easier to recognize.

⑥DATE
The date and time can be adjusted as required.

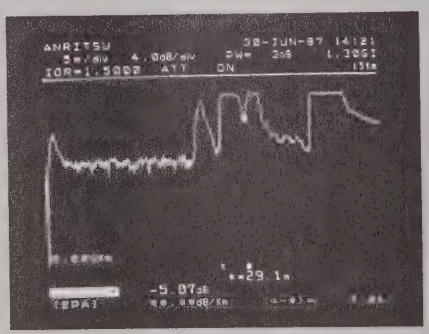
⑦TITLE
A title consisting of up to eight alphanumeric characters and symbols can be assigned to each screen.
This is very useful for keeping records.

⑧MASK (MH958A only)
By using this function, optical masking can be set at an arbitrary point every 2 m on the screen.

● **ATT effectiveness**
Setting the ATT ON reduces the optical pulse output so that two close points can be easily recognized.



Measurement with ATT OFF



Measurement with ATT ON

Detection of connection point location is often difficult because of the influence of Fresnel reflection when measured at ATT OFF.
By setting the ATT ON the detection is made possible in many cases.

Specifications (MW920A + MH951A/MH952A/MH958A)

Main frame		MW920A								
Plug-in unit		MH951A			MH952A			MH958A		
Wavelength		0.85 ± 0.03μm			1.30 ± 0.03μm			1.30 ± 0.03μm		
Applicable fiber		Multimode (50/125μm)						Single-mode		
Optical connector*1		FC-type								
Mask function		Not provided						Provided (Optical)		
Pulse width		3ns	10ns	100ns	3ns	10ns	100ns	3ns	10ns	100ns
Dynamic range (one-way back-scattered light level)		10dB	13dB	18dB	5dB	7dB	14dB	—	5dB	10dB
Dead zone (near end)		3m	5m	20m	3m	4m	20m	8m*7	15m	30m
Distance range		15/40km								
Horizontal axis	Scale (km/full scale)	0.05/0.1/0.5/1/5/10 km (distance range 15 km) 0.5/1/5/10 km (distance range 40 km)								
	Readout resolution*3*4	0.1m (0.05km/full scale) 2m (1km/full scale) 0.2m (0.1km/full scale) 10m (5km/full scale) 1m (0.5km/full scale) 20m (10km/full scale)								
	Shift	0 to 15km (distance range 15km) 0 to 40km (distance range 40km)								
	Accuracy*5	±1m ± measured value × 2×10^{-5} ± readout resolution								
Vertical axis	Scale (dB/div)	0.5/1.0/2.5/4.0								
	Readout resolution	0.01dB								
CRT		5.5 inches, green								
Thermal printer		Built-in								
Video output		Composite video signal: 1 Vp-p (75Ω load), Connector: BNC								
Power		100V, 115V, 120V, 200V, 220V $^{+10\%}_{-15\%}$, 50/60Hz, ≦120VA								
Interface		IEEE Std. 488-1978 Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0								
Ambient temperature		0° to 40°C (spec, meet), −40° to 65°C (storage)								
Dimensions and weight		177H × 284W × 381D mm, ≦13kg								
Laser products classification		21 CFR class 1								

*1 The standard optical connector is FC. For other optical connectors, please consult Anritsu representatives.
*2 Ambient temperature: 20° to 30°C (MH951A/MH952A)
*3 Readout resolution is 0.1m, up to 15km with shift function (distance range: 15km).
*4 Readout resolution is 1m, up to 40km with shift function (distance range: 40km).
*5 Uncertainty due to the refractive index of fiber are not considered.
*6 One GI fiber cord is supplied with the MH951A/MH952A and one SM fiber cord with the MH958A.
*7 This indicates where the Fresnel reflection of the connection point can be detected.

Options

MZ146B DC-AC Inverter	Input: DC 12V/24V ± 15% Output: 125 Vo-p (400Hz square wave)

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MW920A	Optical Time Domain Reflectometer		
	Plug-in units		
MH951A	Plug-in unit		0.85μm, GI fiber
MH952	Plug-in unit		1.3μm, GI fiber
MH958	Plug-in unit		1.3μm, SM fiber
	Standard accessories for MW920A		
J0344	Power cord, 2.5m:	1 pc	
	Fuses for the MW920A, 3.15A (IEC fuse):	4 pcs	For 100V mains
	Fuses for the MW920A, 1.6A (IEC fuse):	4 pcs	For 200V mains
B0172	CRT hood:	1 pc	
	Protective cover:	1 pc	
Z0080	Printer paper:	3 rolls	
	Operation manual:	1 copy	
	Standard accessories for plug-in units		
J0200 B	Optical fiber cord with FC connector, 2m:	1 pc	Supplied with MH951A, MH952
J0056 B	Optical fiber cord with FC connector, 2m:	1 pc	Supplied with MH958
B0174	Case for optical fiber cord:	1 pc	
	Plug-in unit service manual:	1 copy	
	Options		
	Plug-in unit with D4 connector		One FC-D4 conversion cord is attached
	Plug-in unit with RUNGE connector		One FC-RUNGE conversion cord is attached
	Plug-in unit with DIAMOND connector		One FC-DIAMOND conversion cord is attached

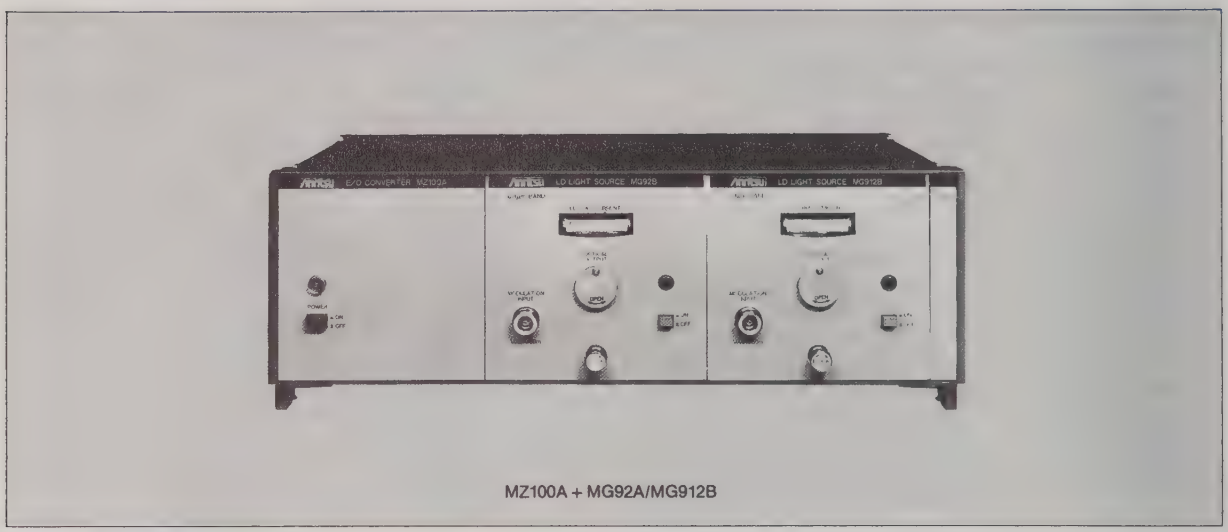
Continued on next page.

Model number/ Order number	Name	Remarks
	Optical accessories	
J0007	GP-IB cable, 1m	408JE-101
J0008	GP-IB cable, 2m	408JE-102
FC-A	Adaptor	For GI fiber
FC-B	Adaptor	For SM fiber
OD-9480	D4 Adaptor	For GI fiber
OD-9484	D4 Adaptor	For SM fiber
J0200 [A], [B], [C]	Optical fiber cord, *m	FC-Z-*M-GI; for GI fiber
J0056 [A], [B], [C]	Optical fiber cord, *m	FC-Z-*M-SM; for GM fiber
J0087 [A], [B], [C]	FC-D4 conversion cord, *m	FC-D4-*M-GI; for GI fiber
J0210 [A], [B], [C]	FC-D4 conversion cord, *m	FC-D4-*M-SM; for SM fiber
J0209 [A], [B], [C]	FC-RUNGE conversion cord, *m	FC-RNG-*M-GI; for GI fiber
J0208 [A], [B], [C]	FC-RUNGE conversion cord, *m	FC-D4-*M-SM; for SM fiber
J0207 [A], [B], [C]	FC-DIAMOND conversion cord, *m	FC-DIA-*M-GI; for GI fiber
J0206 [A], [B], [C]	FC-DIAMOND conversion cord, *m	FC-DIA-*M-GI; for SM fiber
B0175A	A type hard carrying case for MW920A	With caster
B0175B	B type hard carrying case for MW910A	With caster. Can store a packed MW920A in a soft carrying case.
B0178	Soft carrying bag for MW920A	
B0180	Waterproofed case for MW910A	
B0181	Carrying harness for MW920A	For carrying MW920A on one's back
	Peripherals I	
MZ146B	DC/AC Inverter	Switchable for DC 12V/24V input voltage
	Standard accessories for MZ146B	
	AC power cord, 2.5m: 1 pc	
	AC power cord, 0.3m: 1 pc	
	DC power cord, 2.5m: 1 pc	
	Fuses for MZ146B: 2 pcs	For 12V DC input
	Fuses for MZ146B: 2 pcs	For 24V DC input
	MZ146B operation manual: 1 copy	
	Peripherals II	
MP921B	Bare fiber connector	For GI fiber
MP922B	Bare fiber connector	For SM fiber
DDC7707A	PACKET III Personal Technical Computer	
DDC7708A	PACKET IIIs Personal Technical Computer	
G0015	M-085D Polaroid Camera with #85-23 hood	
UA455A	Video printer	Thermal printer. Supplied with one power cord and one BNC cable.
	Carrying case for UA455A Video plotter	
	Supplies	
Z0080	Thermal roll paper for printer	3 rolls/set (for MW910A internal printer)
Z0047	Plotter paper for UA455A	5 rolls/set
Z0077	Mini-floppy disk (2HD)	10 pc/set (for Packet III or IIIs)

* Nomenclature of optical fiber cord concerning their length:

1. Three lengths of 1m, 2m and 3m are standard.
2. These lengths are expressed by symbols A, B and C in order number, for example, J0200 [A], [B], or [C], where, A = 1m, B = 2m, C = 3m.

E/O Converter
MZ100A, MG92A/B, MG912B, MG910A, MG911A



MZ100A + MG92A/MG912B

Features

MG92A/B, MG912B

- Narrow spectral width: less than 0.003 μm.
- Light output stability within 0.6 dB
- Wide frequency range: 100 kHz to 1500 MHz
- Temperature controlled (MG92B and MG912B)

MG910A, MG911A

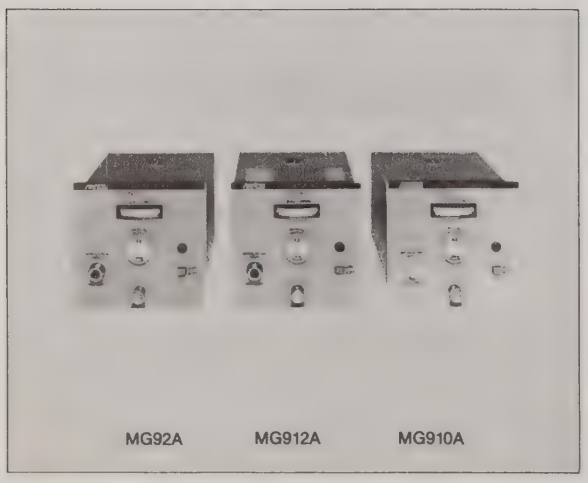
- Light output stability within 0.4 dB

Description

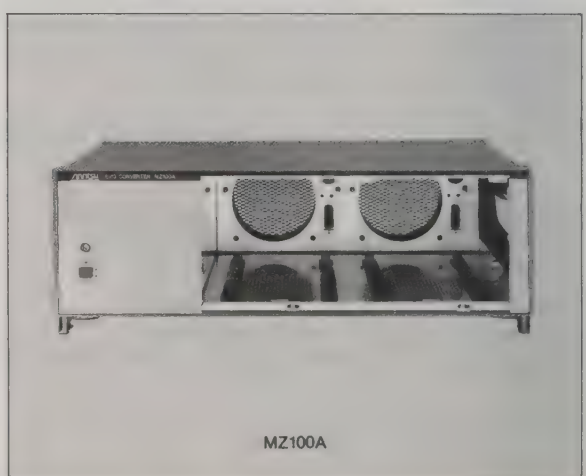
The MG92A/B, MG912B, MG910A, and MG911A are E/O converters for measuring baseband characteristics of optical fiber in conjunction with a general-purpose measuring set for transmission characteristics. By applying an external signal, intensity modulation is possible.

The MG92A/B and MG912B employ a laser diode as a light emitting device, providing a wide range of frequency in modulation and a narrow spectral width. They are also suitable for measuring the baseband characteristics of optical receiving elements and optical fibers.

The MG92A/B and MG912B operate on the 0.85 μm and 1.3 μm bands respectively. As the MG92B and MG912B have internal temperature controllers, changes in the oscillation wavelength due to variations in the ambient temperature are eliminated. The MG910A and MG911A employ a light-emitting diode as a light source. The high stability that is gained through the use of the light-emitting diodes makes them suitable for measuring baseband characteristics of optical fibers, as well as loss measurements of optical components. The MG910A and MG911A operate on the 0.85 μm and 1.3 μm bands respectively.



MG92A MG912A MG910A



MZ100A

Specifications

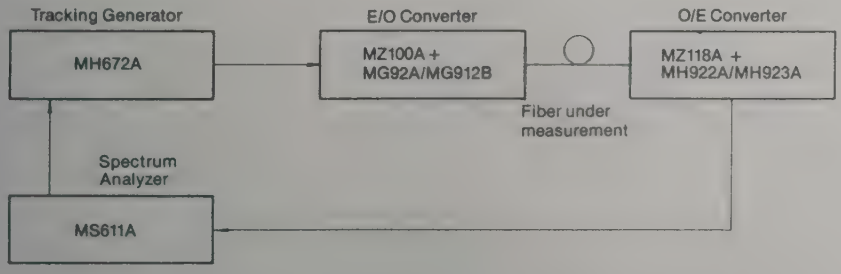
● **MG92A/B, MG912B, MG910A, MG911A**

Model		MG92A/B	MG912B	MG910A	MG911A
Light-emitting element		LD		LED	
Center wavelength		0.85±0.01μm	1.3±0.02μm	0.85±0.01μm	1.3±0.03μm
Temperature characteristics of center wavelength		MG92A ±10nm MG92B ±1nm	—	—	—
Spectral bandwidth*1		≦0.003μm		≦0.05μm	≦0.15μm
Optical output power*2		> −10dBm		> ±18dBm	> −23dBm
Optical output stability		Within 0.6dB		Within 0.4dB	
Modulation frequency range		100kHz to 1,500MHz		100kHz to 50MHz	
Modulation frequency characteristics		6dB*3		3dB	
Max. modulation input level		0dBm (50Ω system)		0dBm (75Ω system)	
Connector	Mod. input	N (S) type		BNC type	
	Opt. output	FC type*4			
Ambient temperature, rated range of use		5°C to 40°C			
Power*5		100V±10%, 50/60Hz, <40VA			
Dimensions and weight		132.5H, 426W, 315D mm, ≦12kg			

*1 When not modulated.
*2 Employing multimode fiber (50/125μm, NA 0.2).
*3 The level difference between modulation characteristics at 100kHz and 1500MHz.
*4 The optical connector of the standard product is FC. Consult us should you need modificaiton of the optical connector.
*5 Specify one nominal AC line voltage between 100V and 250V when ordering.

Example of composition

The example of composition illustrated below combines the Tracking Generator MH672A, Spectrum Analyzer MS611A, the E/O Converter (MZ100A + MG92A/MG912B), and the O/E Converter (MZ118A + MH922A/MH923A). It is for loop measurement of the baseband characteristic of an optical fiber with very high accuracy.



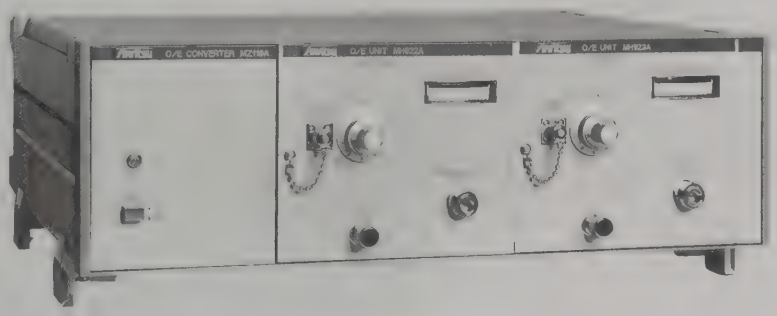
Typical composition of direct observation loop measuring system

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MZ100A	E/O Converter Main Frame		
	Standard accessories		
J0017	Power cord, 2.5 m:	1 pc	
	Fuse for MZ100A, 1A:	2 pcs	
	MZ100A+MG92A Operation manual:	1 copy	A manual of specified combination is supplied.
	MZ100A+MG92B/912B Operation manual:	1 copy	
	MZ100A+MG910A/911A Operation manual:	1 copy	
	Plug-in units		
MG92A	Stabilized Light Source Unit		0.85 μm LD, without temperature control
MG92B	Stabilized Light Source Unit		0.85 μm LD, with temperature control
MG912B	Stabilized Light Source Unit		1.3 μm LD, with temperature control
MG910A	Stabilized Light Source Unit		0.85 μm LED, without temperature control
MG911A	Stabilized Light Source Unit		1.3 μm LED, without temperature control

O/E Converter, O/E Unit
MZ118A, MH922A/MH923A



MZ118A + MH922A + MH923A

Features

- Wide demodulation frequency range
- Built-in preamplifier
- APD current meter
- APD temperature compensating circuit
- Variable optical attenuator

Description

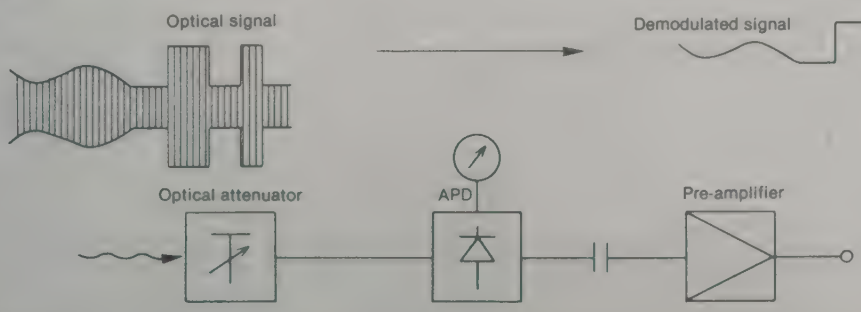
The MZ118A is an O/E converter mainframe used in conjunction with the MH922A or MH923A plug-in O/E units. This assembly converts baseband modulated optical signals to electrical signals, and is designed for use with measuring equipment for optical fiber baseband transmission characteristics. The plug-in O/E units employ an avalanche photodiode (APD) as detector element for high-speed response and excellent sensitivity. Each of the plug-in units also features a variable optical attenuator and a direct-reading APD current meter, allowing the user to adjust the optical level to prevent non-linearity due to APD overload.

In addition, the MZ118A mainframe has a built-in preamplifier that prevents S/N ratio deterioration when the output is coupled to a level meter. The MZ118A can contain up to two plug-in O/E units. Two types of plug-in untis are available: the MH922A for 0.85 μm band, and the MH923A for the 1.3 μm band.

Unit Selection

Wavelength band	Configuration
0.85μm	MZ118A + MH922A
1.3μm	MZ118A + MH923A
0.85μ, 1.3μm	MZ118A + MH922A + MH923A

Block diagram



Specifications

Model		MZ118A + MH922A	MZ118A + MH923A
Wavelength		0.85μm band	1.3μm band
Detector element		Si-APD	Ge-APD
Demodulation frequency range		100kHz to 1GHz*1	
Output signal level		≧ −30dBm*2	
Average output noise		≦ −130dBm/Hz	
Connector	Input	FC types*3	
	Output	Type N (S)	
Variable optical Attenuator		0 to 9dB (in 1dB step) 0 to 30dB (in 10dB steps)	
Compatible fiber		NA ≦0.25, core diameter <80μm	
Ambient temperature, rated range of use		5 to 40°C	
Power supply		AC 100V ±10%, 50/60Hz, ≦7VA	
Dimensions and weight		132.5H, 426W, 351Dmm, 12kg	

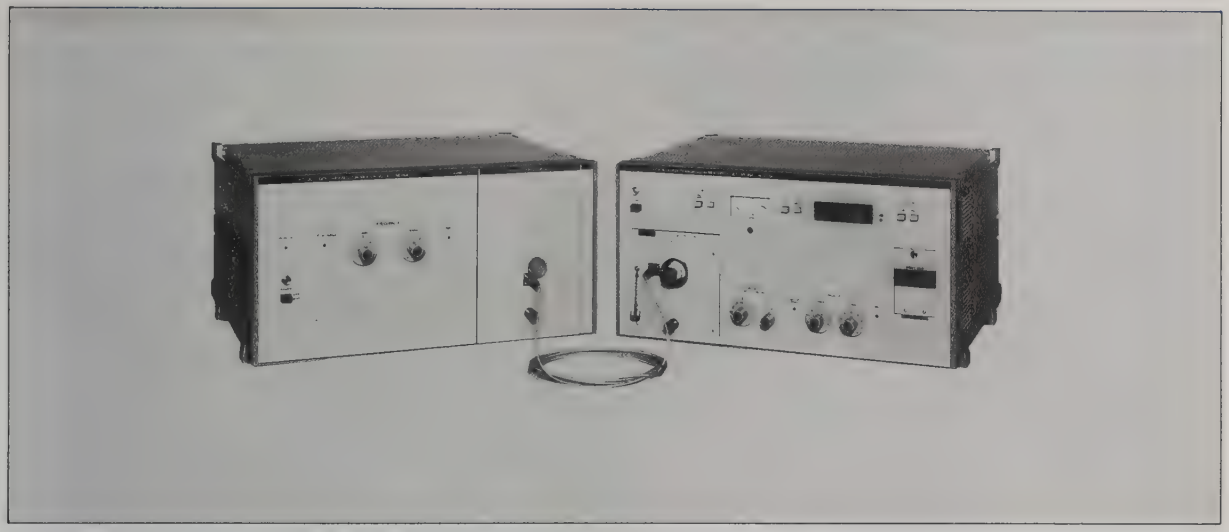
*1 Frequency response within 6dB.
*2 When an optical signal (average power −30dBm) modulated 80% by a sinewave signal is applied.
*3 FC optical connectors are supplied as standard. Consult with Anritsu when other types of connectors are required.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MZ118A	O/E Converter		
	Standard accessories		
J0017	Power cord, 2.5 m:	1 pc	
	Fuse for MZ118A, 0.5A:	2 pcs	MF51NN250V0.5AAC05
	MZ118A Operation manual:	1 copy	
	Plug-in units		
MH922A	O/E Unit		0.85 μm } Specify the unit you need
MH923A	O/E Unit		1.3 μm }

Optical Fiber Transmission Measuring Set ME96A/B/C



Features

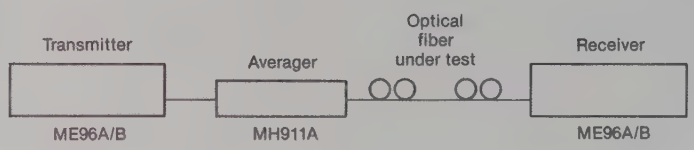
- Pre-calibrated frequency characteristics for highly accurate end-to-end measurements
- Wide 1 to 800 MHz frequency range
- Wide dynamic range ideal for measuring long-distance optical fiber cables involving high losses
- Digital readout of baseband characteristics with reference to any designated frequency
- Built-in printer for hardcopy printout of measured characteristics

Description

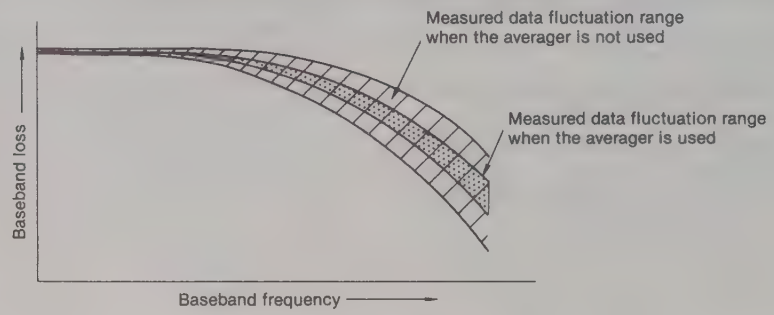
The ME96A/B/C are optical fiber transmission measuring sets designed to measure the baseband characteristics of optical fiber transmission lines.
The ME96A permits measurements at both the 0.85 μm and 1.3 μm bands by simply changing the plug-in unit in the transmitter and the receiver. The ME96B measures at the 0.85 μm waveband, while the ME96C measures at the 1.3 μm waveband.

Measurement system

For more stable baseband characteristics measurements in the 0.85 μm band, the MH911A Averager (option) can be added. This unit compresses the fluctuation in baseband characteristics caused by speckle noise.

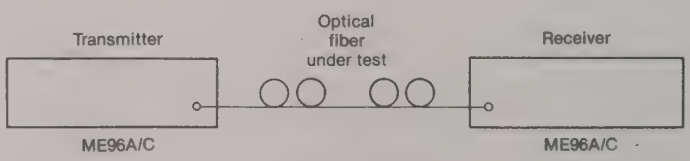


Measurement system using the Averager MH911A


Measured data fluctuation range when the averager is not used
Measured data fluctuation range when the averager is used
Baseband loss
Baseband frequency

Effect of averager function

Measurements in the 1.3μm band do not require the MH911A because the transmitter is already equipped with a device to compress the speckle noise in that band.



Measurement system using no averager

Functions

This set employs the swept frequency method to achieve a wide dynamic range and highly accurate measurements with an excellent S/N ratio. The frequency range is 1MHz and 10 to 800MHz in 10MHz steps. The set consists of a transmitter containing the oscillator and light source, and a receiver containing the O/E unit and a selective level meter.

The frequency characteristics of the set are pre-calibrated, permitting highly accurate far-end measurements of optical transmission lines.
The measured values of the baseband characteristics are indicated by a digital display in the receiver unit. A built-in printer permits hardcopy printout of the measured frequency and baseband loss level values.

Composition

Description		ME96A	ME96B	ME96C	Remarks
Main frame	Transmitter	1	1	1	
	Receiver	1	1	1	
Plug-in unit	MG92B1 Light Source	1	1	—	LD. 0.85μm
	MG912B1 Light Source	1	—	1	LD. 1.3μm
	MH99A O/E Converter	1	1	—	0.85μm band
	MH910A O/E Converter	1	—	1	1.3μm band
Accessories supplied	Optical fiber cord	1	1	1	2m
	Power cord	2	2	2	
	Recording paper	3 rolls	3 rolls	3 rolls	
	Frequency control cord	1	1	1	
Optional apparatus	MH911A Averager	(1)	(1)		

Specifications

● **ME96A/B/C**

		ME96A		ME96B	ME96C
Wavelength		0.85 ±0.01μm	1.30 ±0.02μm	0.85 ±0.01μm	1.30 ±0.02μm
Fiber type		Multi-mode (50/125μm, NA 0.2)			
Frequency range		1MHz and 10 to 800MHz (in 10MHz steps)			
Frequency characteristics		≦0.9dB (10 to 800MHz)*1, Temperature variation: ≦1dB			
Dynamic range*2	Optical loss	35dB	20dB	35dB	20dB
	Baseband frequency characteristics	20dB			
Optical attenuator variable range		39dB (1dB × 9 and 10dB × 3)			
Connector*3		FC type			
Power (Transmitter and Receiver)*4		AC 100V ±10%, 50/60Hz, <70VA			
Ambient temperature, rated range of use		10° to 40°C			
Dimensions and weight	Transmitter	221.5H, 426W, 391Dmm, <20kg			
	Receiver	221.5H, 426W, 391Dmm, <20kg			

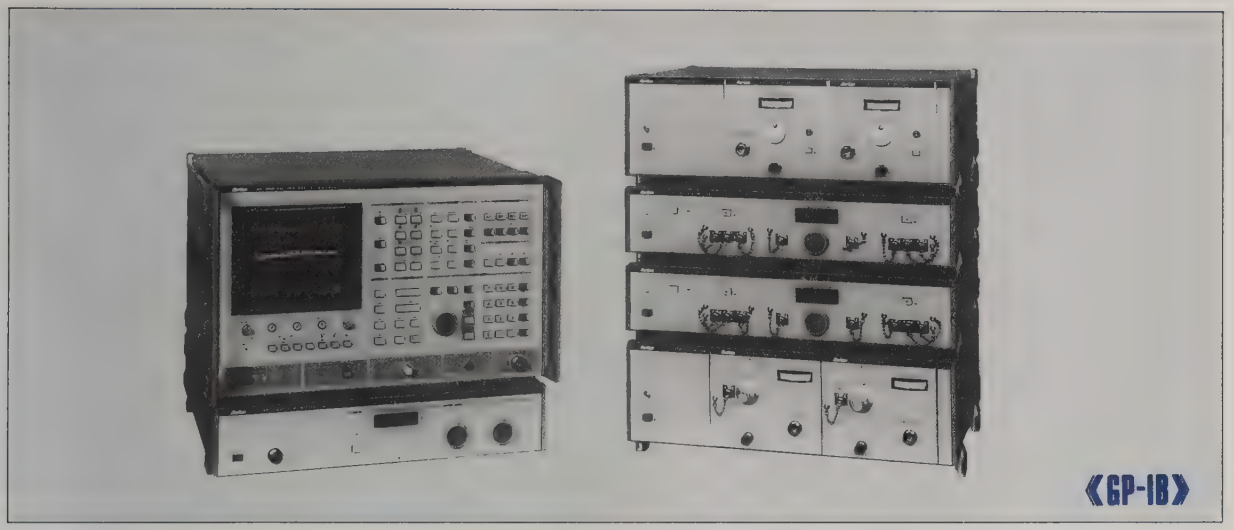
*1 At 25°C
*2 Measurement can be performed for 0 to 20dB in the baseband frequency characteristic regarding a fiber under measurement and 0 to 35dB at 0.85μm or 0 to 20dB at 1.30μm in optical loss.
*3 The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.
*4 Specify one nominal AC line voltage between 100V and 250V when ordering.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
ME96A	Optical Fiber Transmission Measuring Set		For 0.85 μm/1.3 μm band
ME96B	Optical Fiber Transmission Measuring Set		For 0.85 μm band
ME96C	Optical Fiber Transmission Measuring Set		For 1.3 μm band
	Plug-in units		
MG92B1	Light Source		0.85 μm LD. A component unit of ME96A/B
MG912B1	Light Source		1.3 μm LD. A component unit of ME96A/C
MH99A	O/E Converter		0.85 μm. A component unit of ME96A/B
MH910A	O/E Converter		1.3 μm. A component unit of ME96A/C
	Standard accessories		
J0017	Power cord, 2.5 m:	2 pcs	
J0200B	Optical fiber cord, 2 m:	1 pc	
J0199	Frequency control cord:	1 pc	
Z0053	Printer paper:	3 rolls	EUY-2T (Blue)
	Fuse for ME96A/B/C, 2A:	4 pcs	MF51NN250V2AAC05
	Fuse for ME96A/B/C, 0.5A:	1 pc	MF51NN250V0.5AAC05
	ME96A/B/C Operation manual:	1 copy	
	Optional accessories and apparatus		
MH911A	Averager		
J0282	Optical fiber cord		For baseband measurement (SGS driver)

Optical Fiber Transmission Measuring Equipment ME98A/B/C/D/E/F



Features

- Measuring baseband frequency characteristics for multi-mode fiber.
- Highly accurate measurement using the comparison method.
- Wide frequency range of 100 kHz to 1000 MHz.
- Automatic measurement via GP-IB.

Applications

- Research and development, and manufacturing inspection of optical fiber.

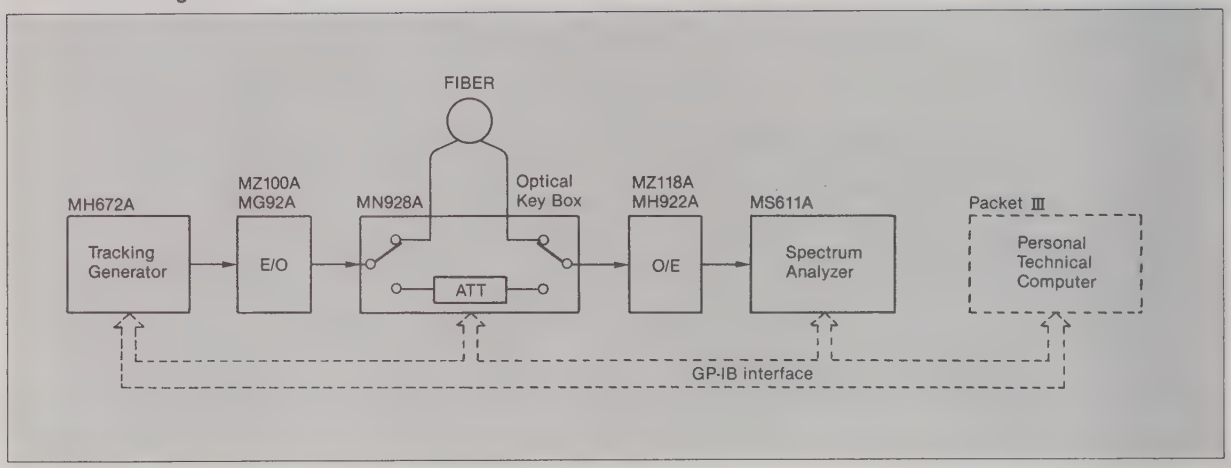
Description

Optical Fiber Transmission Measuring Equipment ME98 (consisting of a Spectrum Analyzer MS611A, Tracking Generator MH672A, E/O Converter MZ100A, O/E Converter MZ118A, and Optical Key Box MN928A/MN929A) can measure baseband frequency characteristic of multi-mode fiber in the range of 100 kHz to 1000 MHz. Since this device employs the frequency sweep method, measurement is quite easy, and the baseband frequency characteristics can be directly observed on the CRT. Two independent memory and operation functions of the Spectrum Analyzer MS611A enable highly accurate measurement by compensating for internal characteristics of the measuring system. The marker function enables measurement of baseband attenuation and frequency not only at the 6 dB point, but also at any other desired point that can be directly monitored by the CRT. The Optical Key Box enables simple switchover between measured and standard fibers; along with the built-in programmable variable attenuator, this device helps realize sophisticated automatic measurement. Both the Spectrum Analyzer MS611A and the Optical Key Box are equipped with GP-IB interface.

Measurement System

	ME98	A	B	C	D	E	F
E/O	MZ100A E/O Converter (main frame)	1	1	1	1	1	1
	MG92A Light Source Unit	1		1			
	MG912B Light Source Unit		1	1			
	MG910A Light Source Unit				1		1
	MG911A Light Source Unit					1	1
O/E	MZ118A O/E Converter (main frame)	1	1	1	1	1	1
	MH922A O/E Unit	1		1	1		1
	MH923A O/E Unit		1	1		1	1
MN928A Optical Key Box		1		1	1		1
NM929A Optical Key Box			1	1		1	1
Electrical System	MS611A Spectrum Analyzer	1	1	1	1	1	1
	MH672A Tracking Generator	1	1	1	1	1	1

ME98A block diagram



Combination Corresponding to the Optical Wavelength and Frequency to be Measured

Model	Wavelength range	Frequency range
ME98A	0.85μm	100kHz to 1000MHz
ME98B	1.3μm	100kHz to 1000MHz
ME98C	0.85μm, 1.3μm	100kHz to 1000MHz
ME98D	0.85μm	100kHz to 50MHz
ME98E	1.3μm	100kHz to 50MHz
ME98F	0.85μm, 1.3μm	100kHz to 50MHz

Specifications

Model	ME98A	ME98B	ME98C	ME98D	ME98E	ME98F	
Wavelength (μm)	0.85	1.3	0.85, 1.3	0.85	1.3	0.85, 1.3	
Light emitting element	Laser diode			Light emitting diode			
Optical output*1	≧ −10dBm (100μW)			≧ −18dBm (15.8μW)	≧ −23dBm (5.0μW)	0.85μm ≧ −18dBm	1.3μm ≧ −23dBm
Optical measuring range*2	40dB	35dB	40dB (0.85μm) 35dB (1.3μm)	30dB	30dB	30dB	
B.B. frequency range	100kHz to 1000MHz			100kHz to 50MHz			
Display scale	LIN, LOG: 1, 2, 5, 10dB/div.						
Setting range for frequency span	Frequency span: 100Hz to 2.09GHz. 3 digits (100 to 999) can be varied over 10 horizontal scales and 0Hz (fixed tuning).						
Scan time	Manual setting, 20ms to 1000s, and automatic setting corresponding to the frequency span resolution bandwidth and the video bandwidth. 10μs to 1000s can be set for 0Hz frequency span.						
Resolution bandwidth	10Hz to 3MHz. Manually or automatically set corresponding to the frequency span.						
Level measurement resolution	0.01dB						
Compatible fiber	NA: ≦0.25, core diameter: ≦80μm						
Ambient temperature, rated range of use	5 to 40°C						

*1 Core diameter 50/125μm NA 0.2, using GI fiber.
*2 Including insertion loss of Optical Key Box.

Application equipment

Packet III Personal Technical Computer	Used as the external controller for ME98.
UA-455 Video Plotter	The UA-455 Video Plotter can easily be connected to the MS611A Spectrum Analyzer, making it simple to obtain a hard copy of data on the CRT screen. Note: The Video Plotter uses signal output function (option) of the MS611A Spectrum Analyzer.
MH689A Pulse Amplitude Modulator	Reducing speckle noise of 1.3μm band optical fiber.
MH911A Averager	Reducing speckle noise of 0.85μm band optical fiber.
MB23A Test Mobile	Easily transported folding cart. • Maximum capacity: 40kg • Table angle: Variable • Power source outlets: Five outlets

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name	Remarks
	Main frame	
ME98A	Optical Fiber Transmission Measuring Equipment	
ME98B	Optical Fiber Transmission Measuring Equipment	
ME98C	Optical Fiber Transmission Measuring Equipment	
ME98D	Optical Fiber Transmission Measuring Equipment	
ME98E	Optical Fiber Transmission Measuring Equipment	
ME98F	Optical Fiber Transmission Measuring Equipment	
	Component untis	
MZ100A	E/O Converter (main frame)	Common to all models
MG92A	Light Source Unit	0.85 μm LD. A component unit of ME98A/C
MG912B	Light Source Unit	1.3 μm LD. A component unit of ME98B/C
MG910A	Light Source Unit	0.85 μm LED. A component unit of ME98D/F
MG911A	Light Source Unit	1.3 μm LED. A component unit of ME98E/F
MZ118A	O/E Converter (main frame)	Common to all models
MH922A	O/E Unit	0.85 μm. A component unit of ME98A/C/D/F
MH923A	O/E Unit	1.3 μm. A component unit of ME98B/C/E/F
MN928A	Optical Key Box	0.85 μm. A component unit of ME98A/C/D/F
MN929A	Optical Key Box	1.3 μm. A component unit of ME98B/C/E/F
MS611A	Spectrum Analyzer	
MH672A	Tracking Generator	

Continued on next page

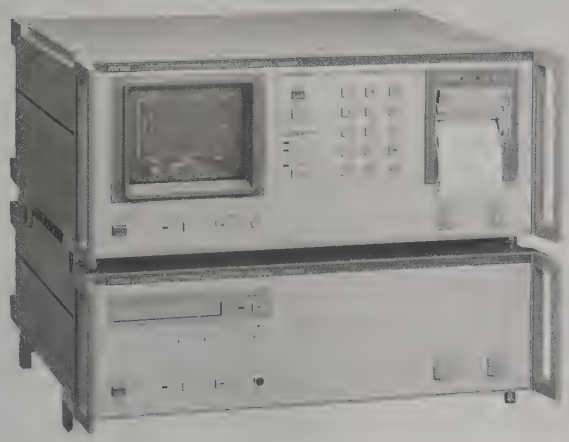
(Continued)

Model number/ Order number	Name		Remarks
	Standard accessories (1)		Common to all models
J0025A	Coaxial cord, 1 m:	1 pc	S-5DWP•5D-2W•S-5DWP
J0104	Coaxial cord, 1 m:	1 pc	BNC-P•RG-55/U•N-P
J0116	Coaxial cord, 0.5 m:	2 pcs	HRM202•Special 3D-2W•HRM202
J0114A	Coaxial cord, 1 m:	1 pc	UG-21D/U•RG-9A/U•UG-21D/U
J0114C	Coaxial cord, 1.5 m:	2 pcs	UG-21D/U•RG-9A/U•UG-21D/U
	Fuse for MZ100A, 1A:	2 pcs	MF51NN250V1AAC05
	Fuse for MZ118A, 0.5A:	2 pcs	MF51NN250V0.5AAC05
	Fuse for MS611A, 5A:	2 pcs	MF51NN250V5AAC05
	Fuse for MH672A, 1A:	2 pcs	MF51NN250V1AAC05
	ME98□ Operation manual:	1 copy	
	MS611A Operation manual:	1 copy	
	MH672A Operation manual:	1 copy	
	Standard accessories (2)		Supplied with each model
J0200D	Optical fiber cord, 0.3 m:	*pcs	*ME98A/B/D/E: 2 pcs, ME98C/F: 4 pcs
J0200E	Optical fiber cord, 0.6 m:	*pcs	*ME98A/B/D/E: 2 pcs, ME98C/F: 6 pcs
J0017	Power cord, 2.5 m:	*pcs	*ME98A/B/D/E: 3 pcs, ME98C/F: 6 pcs
	Fuse for MN928A, 1A:	2 pcs	MF51NN250V1AAC05. Supplied with ME98A/C/D/F
	Fuse for MN929A, 1A:	2 pcs	MF51NN250V1AAC05. Supplied with ME98B/C/E/F
	Optional accessories and apparatus		
DDC7707A	Packet III Personal Technical Computer		
	UA-455 Video Plotter		
MH689A	Pulse Amplitude Modulator		
MH911A	Averager		
MB23A	Portable Test Rack		
J0282	Optical fiber cord		For baseband measurement (SGS driver)

Chromatic Dispersion Measuring Set ME9301A

1.3 μm/1.55 μm

NEW



《GP-IB》

Advances in optical fiber communication technology mean faster data transmission speeds and expanded transmission capacity. Extending the distance between repeaters makes precise analysis of communications circuit characteristics even more essential to system design.
Chromatic dispersion is a critical factor affecting optical fiber transmission performance. Now, just 20 seconds and a few simple procedures is all it takes for Anritsu's ME9301A Chromatic Dispersion Measuring Set to tell you how much there is. Just the transmitter and receiver are needed to measure installed single-mode cable, inspect it during manufacture, or conduct research and development.

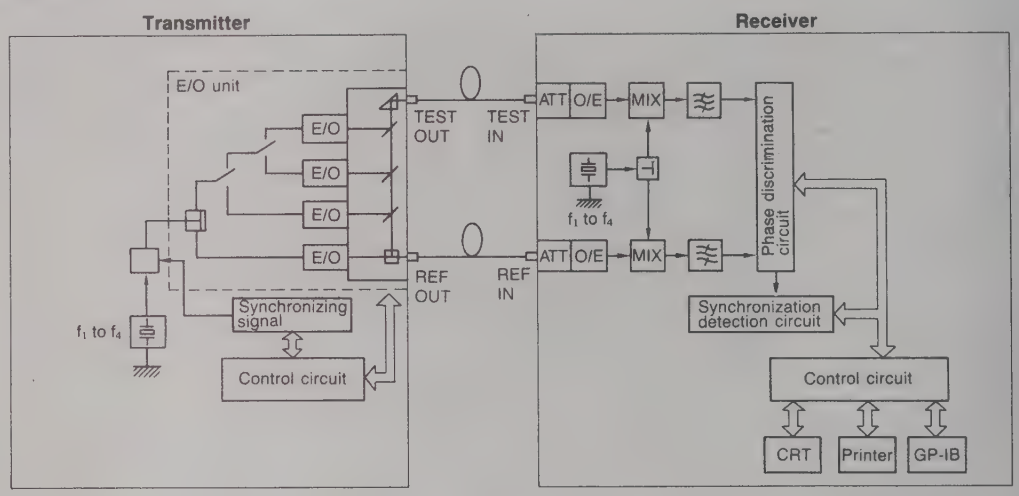
Features

- **Far-end measurement**
  The chromatic dispersion of both old and newly installed optical fiber lines can be measured easily.
- **Easy and quick to use**
  A programmable optical attenuator automatically controls the optical input level at the receiver to enable fast measurement (approximately 20 seconds) with fewer control operations.
- **Measures both 1.3 μm and 1.55 μm bands**
  Just change the light source to measure fibers using either 1.3 or 1.55 μm bands.
- **High measurement reproducibility**
  An optical isolator, high frequency superimposition, and temperature control stabilize the LD emission spectra. The measured data is averaged over 1000 points to assure very high measurement reproducibility (typically: ±0.05 ps/nm/km).
- **Wide dynamic range**
  No problems are caused by optical losses of more than 30 dB (1.3 μm band) and 25 dB (1.55 μm band).
- **Automatic received light level setting**
  Measurement is performed at the best receiving level because the optical attenuator adjusts automatically to compensate for the optical loss of the fiber under test.
- **Various output methods**
  The measurement data can be read on the CRT, printed out on the built-in thermal printer, or displayed at an external video terminal. The results can also be plotted directly on an external printer or plotter via GP-IB.

Applications

1.3 μm and 1.55 μm single-mode fibers
- Research and development
- Shipment and acceptance tests
- Analysis of installed lines

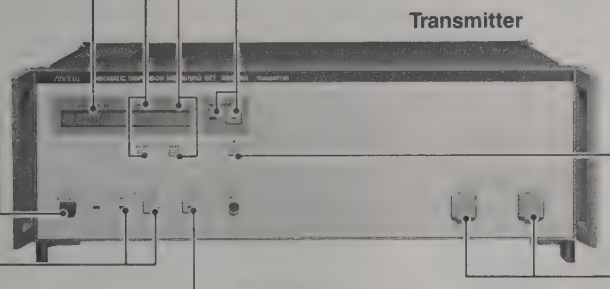
Block Diagram



Configuration

The configuration of the ME9301A depends on the type of optical fiber to be measured.

ME9301A	1.3μm band zero dispersion fiber	1.55μm band zero dispersion fiber
Transmitter	○	○
E/O Unit ME0901A	○	—
E/O Unit ME0902A	—	○
Receiver	○	○



OSC No.
Indicates selected oscillator number. Use SELECT key to choose oscillator.

λ No.
Indicates selected light source number. Use SELECT key to choose light source.

MEASUREMENT
AUTO lamp lights during automatic measurement controlled by receiver. Push START key to begin manual measurement; push it again to stop measurement.

MEASURING BAND
E/O unit enables indication of the measuring band.

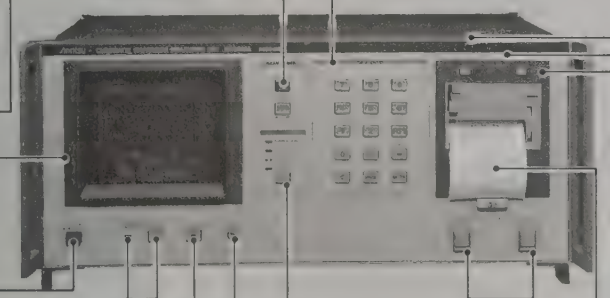
LEVEL MONITOR
During far-end measurement, confirm incident light level of measured fiber by connecting optical power sensor (option) to MONITOR INPUT.

POWER
Lamp on right is lit when power is ON.

OPTICAL OUTPUT
Measurement output terminals. Connect the fiber to be measured to TEST and reference signal fiber to REF.

GP-IB
Lamp lights when controlled via GP-IB. Press key to release remote control.

SELF TEST
Press key to check system operation when transmitter and receiver are connected.



CRT
Displays measurement conditions and results (graphic and numeric data). Select display format and contents with DATA ENTRY and DISPLAY keys.

DATA ENTRY
Used for input of necessary measurement data, including fiber length and number.

PRINT
Press once to start built-in printer output; press again to stop. Lamp is lit during printing.

MEASUREMENT
MANUAL key: For far-end measurement.
AUTO key: For near-end measurement, can measure without operating the transmitter.

PAPER
Lamp lights and alarm sounds when printer runs out of paper.

POWER
Lamp on right is lit when power is ON.

FEED
Advances paper.

OPTICAL INPUT
Measurement input terminals. Connect the fiber to be measured to TEST and reference signal fiber to REF.

GP-IB
Lamp lights when controlled via GP-IB. Press key to release remote control.

Thermal Printer
Produces hard copy of CRT display.

EXT PLOTTER
Results displayed on CRT can be output to external plotter or printer via GP-IB.

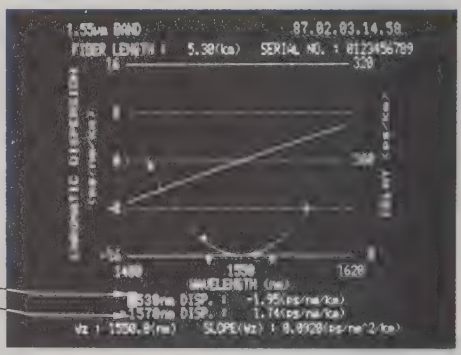
INTENSITY
Adjusts CRT display brightness.

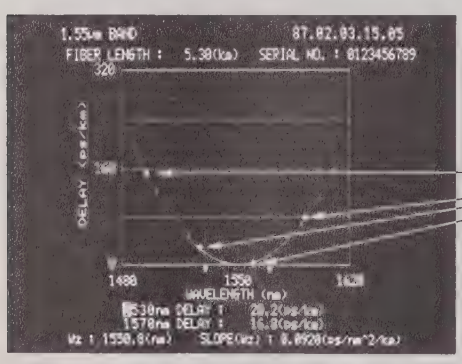
DISPLAY
Chooses display format.

Functions

● Versatile CRT display

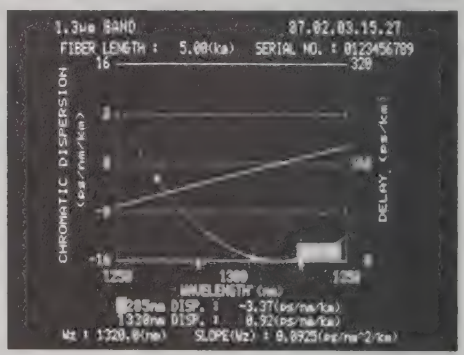
The dispersion of a selected wavelength can be read on the CRT.

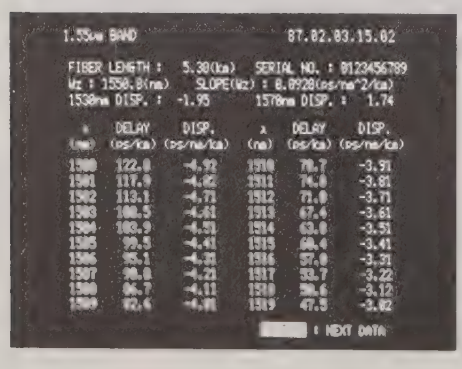




● The CRT display clearly indicates agreement between the approximation curve and the point (+) measured.

The display can be expanded in the area of 1.3μm when measuring that band.

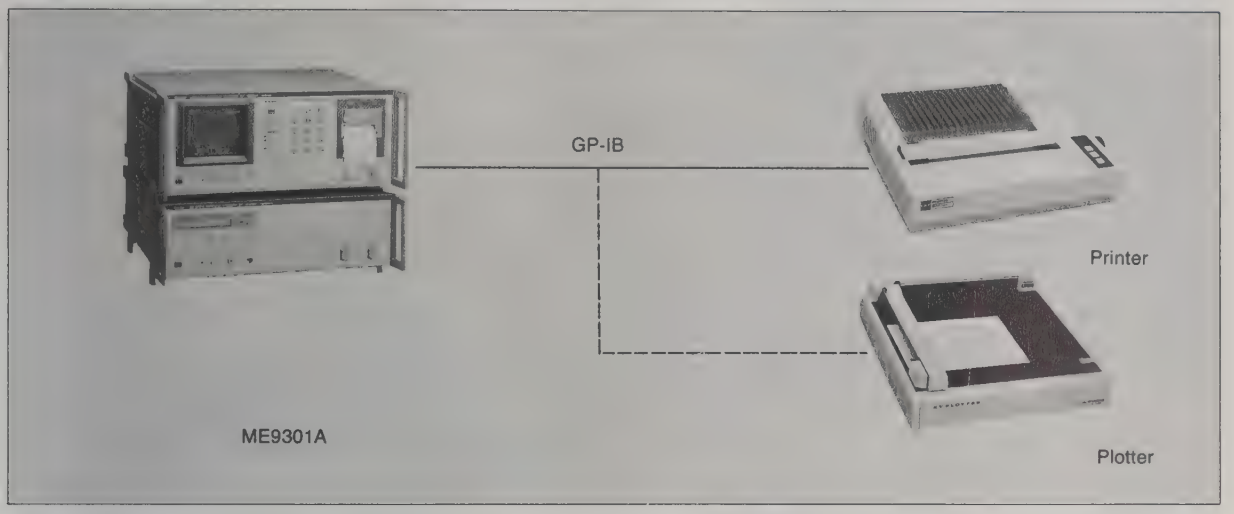


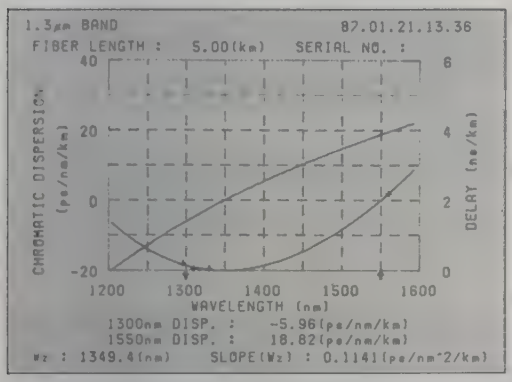


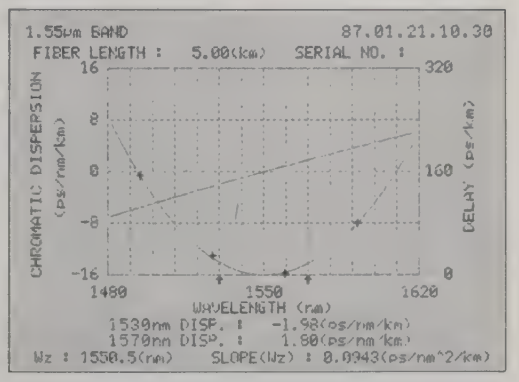
The wavelength intervals of the numerical data display can be selected (1, 5, 10, or 50 nm).

● Direct plot/print functions

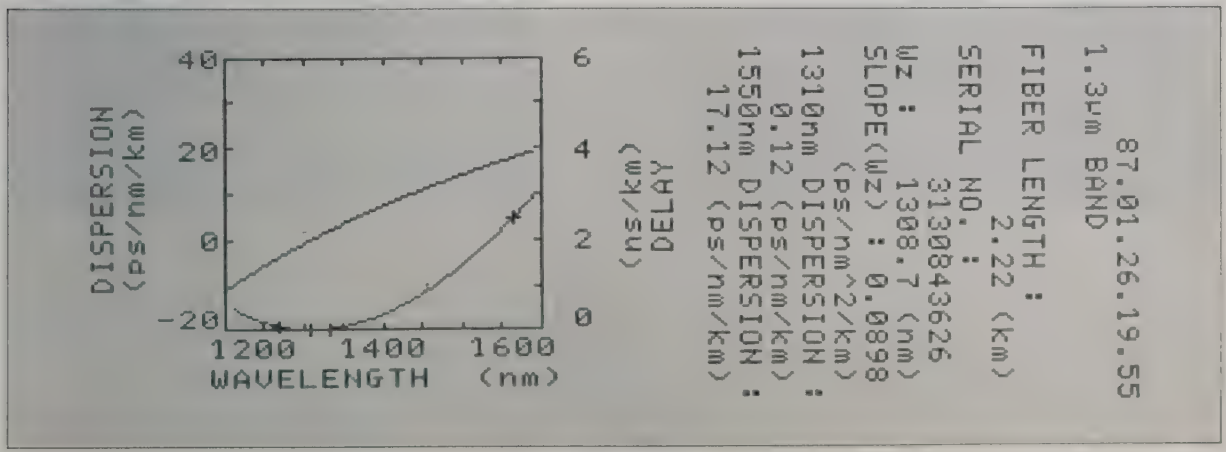
1. The measurement results can be output directly to an external printer or plotter via GP-IB.







2. Handy printout of results from built-in thermal printer.



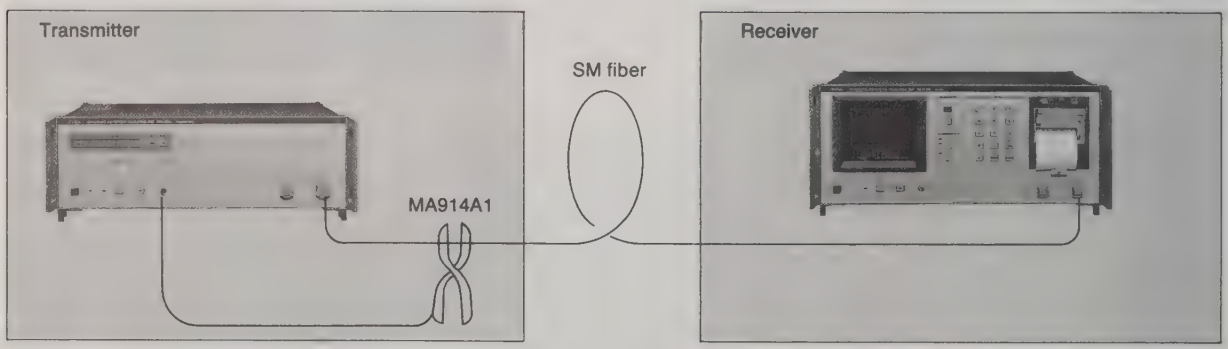
Specifications

Item \ Model		ME9301A	
		ME0901A (1.3μm band)	ME0902A (1.55μm band)
Measuring wavelength range*		Approx. 1.25 to 1.55μm (4 waves)	Approx. 1.5 to 1.6μm (4 waves)
Allowable optical loss		≧30dB	≧25dB
Applicable fiber		1.3μm band zero dispersion fiber	1.55μm band zero dispersion fiber
Measuring accuracy		±0.3 ps/nm/km (at 1.25 to 1.35μm and 1.5 to 1.6μm)	
Resolution	Dispersion	0.01 ps/nm/km	
	Zero dispersion wavelength	0.1nm	
	Slope	0.0001 ps/nm•nm/km	
Minimum measuring fiber length		1km	
Optical connector**		FC-type (standard)	
Operating temperature range		0° to 40°C	
Power		AC 100V % $^{+10}_{-15}$, ≦60VA (transmitter) ≦130VA (receiver)	
Dimensions and weight		132.5H×426W×351D mm, ≦15kg (transmitter) 177H×426W×351D mm, ≦17kg (receiver)	
Accessories		Optical fiber cable (with FC plugs at both ends): 2 Coaxial cord: 1 RS-232C cable: 1 Thermal print paper rolls: 2	

*The standard wavelength values are;
Approx. 1.26, 1.30, 1.34, and 1.53μm for ME0901A
Approx. 1.50, 1.53, 1.56, and 1.59μm for ME0902A
**The standard connector is an FC type, contact us if you need another kind.

Optional Accessories

MA914A1 Optical Power Sensor (for Level Monitoring)
When far-end measurement is made using a mechanical splice, the incident light level can be monitored from the transmission side while splicing by using this optical power sensor.



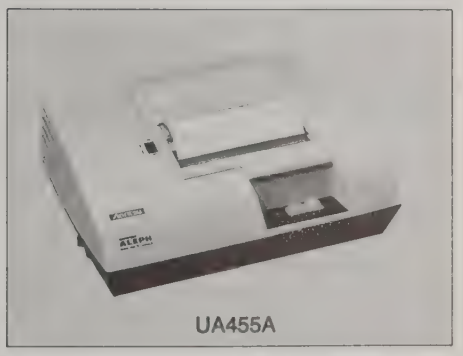
Plotters
The information on the CRT can be plotted via GP-IB directly on A4-size paper.
Applicable plotters: FP-5301-1-11 and MP2000 (Graphtec), VP-6803A (Matsushita), HP7475A and HP7550A (Hewlett Packard), etc.

FP5301-1-11

DPR7713A

Printers
A printer can produce a copy of the CRT display via GP-IB.
Applicable printers: DPR7713A (Anritsu), FP-80 (Epson).

Video Plotter
A hard copy of the CRT display can also be reproduced using a video plotter.
Applicable video plotter: UA455A (Nippon Aleph).



UA455A

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name		Description
	Main unit		
ME9301A	Chromatic Dispersion Measuring Set		
	Transmitter		
	Receiver		
	Plug-in units		
ME0901A	E/O unit		For 1.3μm band fiber
ME0902A	E/O unit		For 1.55μm band fiber
	Standard accessories		
J0056J	Optical fiber cable, 0.3 m:	2	For SM
	Coaxial cord, 7 cm:	1	
	RS-232C cable, 0.5 m:	1	
J0017	Power cord, 2.5 m:	2	
Z0031A	Thermal printer paper rolls:	2	
	Instruction manual:	1	
	Transmitter fuses, 1.6 A (AC):	2	IEC fuse
	Transmitter fuse, 1 A (DC):	1	IEC fuse
	Transmitter fuses, 0.315 A (AC)	4	IEC fuse
	Receiver fuses, 3.15 A (AC):	2	IEC fuse
	Receiver fuses, 1.6 A (DC):	2	IEC fuse
	Receiver fuse, 1 A (DC):	1	IEC fuse
	Receiver fuses, 0.5 A (DC):	3	IEC fuse
	Optional accessories		
MA914A1	Optical Power Sensor		For level monitoring
	Hard carrying case for ME9301A		
	Soft carrying case for ME9301A		
	Additional equipment		
DPR7713	Printer		See page 169 for other printer and plotter models.

Automatic LD Test System
ME9002A

Features

- One system covers wavelength range from 0.6 μm to 1.6 μm for all measurement items.
- Test temperatures can be specified right in the program, making it easy to obtain data for temperature characteristics.
- Pulse drive technique allows measurement of I-L characteristics without effects from heat generation, even at high levels of optical power.
- Personal computer and interactive language make writing and editing test program remarkably easy.
- Automatic paper supply (up to 150 sheets) to plotter.

Measuring Items

• Current vs. Optical power	I-L
• Current vs. LD forward voltage	I-V
• Current vs. Monitor current	I-Im
• Spectrum pattern	
• Far-field pattern	FFP
• LD leak current	
• PD leak current	

Description

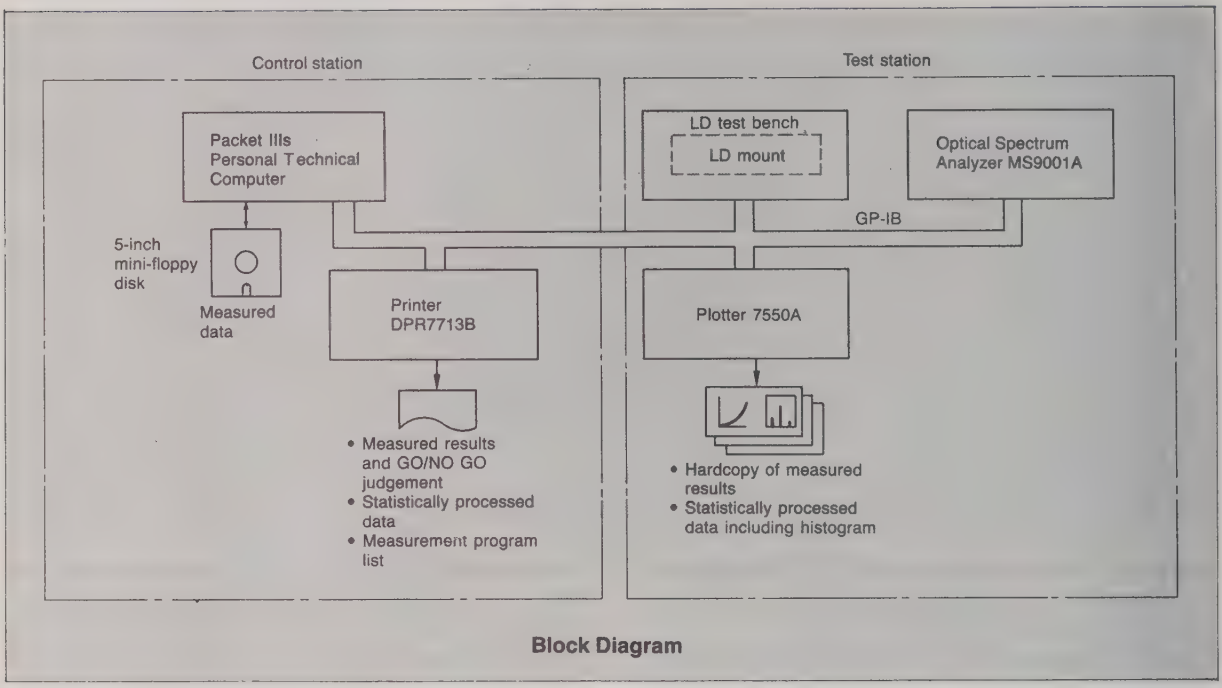
The ME9002A Automatic LD Test System offers complete testing and measurement of the characteristics of semiconductor laser diodes and photodiodes (built-in monitor photodiode). It is completely automatic, making it ideal for production-line use, and its temperature-controlled stability is suitable even for laboratories and R&D facilities.

The LD or PD is simply placed on a test mount; the ME9002A does the rest. All measurements are automatic including not only items directly related to LD drive current (such as optical power, forward voltage and monitor diode current), but also spectral characteristics, far field pattern (FFP), even LD and PD leak current.

Measuring programs are written on a personal computer using a convenient interactive procedure. Programs are assigned easy to remember names; then measurement is begun simply by specifying the name.

The measured results are displayed on the personal computer CRT, and can be output to a plotter for inclusion as part of a test report. Results can also be output on a printer, and this output can depend on a GO/NO GO decision based on one or more measurement parameters.

For saving results, a 5-inch minifloppy disk gives a big 1M byte of memory space. This data can be recalled and processed by a sophisticated statistical program for use in quality control or other calculations.



Block Diagram

System configuration

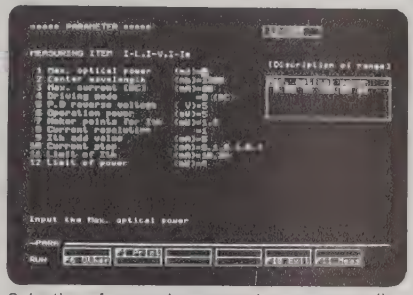
Item	Model/Name	Q'ty	Remarks
Control station	Packet IIIs Personal Technical Computer	1	With 2 FD drives
	DEU7775A GP-IB Interface	1	Installed within the Packet IIIs
	DMM7763A 1MB RAM	1	
	DPR7713B Printer	1	
	Rack	1	
Test station	7550A Plotter	1	
	MS96A Optical Spectrum Analyzer	1	
	LD Test Bench	1	
	LD Test Mount*	1	For 10 channels
	Rack	1	
Software (measurement program, statistical processing program)		1 set	Supplied on 5-inch mini floppy disks
Accessories supplied	ME9002A Instruction Manual	1 set	
	Instruction manuals for each instrument	1 set	Including Packet IIIs, MS9001A, DPR7713B and 7550A
	Printing paper for DPR7713B Printer	1	
	5 inch mini floppy disk	10 ea.	For data storage

* A test mount suited for shape of LD to be measured is required. Be sure to consult Anritsu before ordering.

Measured Result Examples

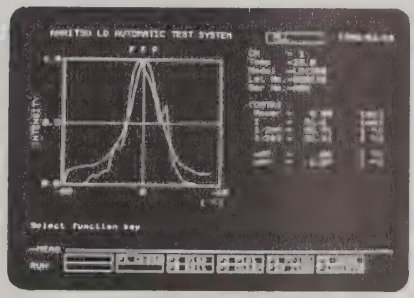
The ME9002A system is easy to use, thanks to sophisticated software that permits interactive entry. A variety of measuring conditions and parameters can be specified, allowing testing of LDs and PDs at conditions that closely duplicate actual real-world and worst-case conditions—no matter what the eventual application.

Selection of measuring items and temperature

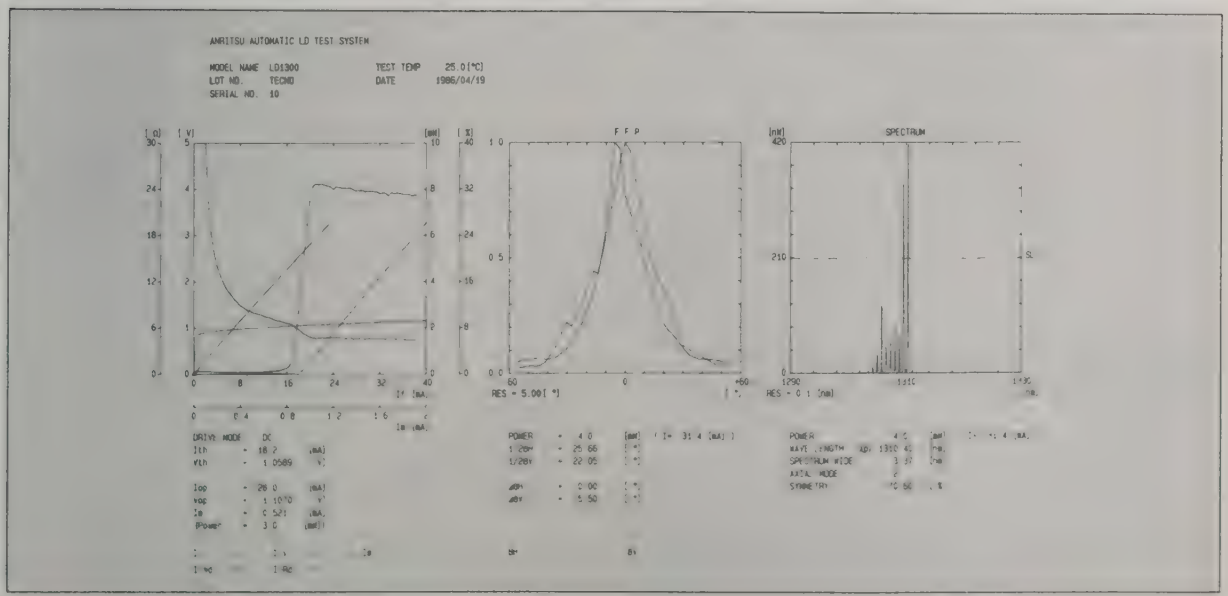


Selection of measuring parameters corresponding to measurement items

Selection of plotting items



Example of measured data



Example of plotter output

Main Specifications

● Measuring items and data processing

Main measurement item	Output data		Output					
			CRT		Plotter		Printer	Floppy disk
			Graph	Numerical value	Graph	Numerical value	Numerical value	Numerical value
I-L I-V I-Im	Current vs. optical power,	I-L	○		○			
	Current vs. LD forward voltage,	I-V	○		○			
	Current vs. monitor current,	I-Im	○					
	Current vs. quantum differential efficiency,	I-ηd			○			
	Current vs. differential resistance,	I-Rd, $Rd=\frac{\Delta V}{\Delta I}$			○			
	Current vs. differential voltage,	I-Vd, Vd=Rd•I			○			
	Optical power vs. monitor current,	L-Im			○			
	Threshold current,	Ith		○		○	○	○
	LD voltage at threshold current,	Vth		○		○	○	○
	LD driving current at specified power,	Iop		○		○	○	○
	LD forward voltage at specified power	Vop		○		○	○	○
	PD monitoring current at specified power	Im		○		○	○	○
	PD dark current at specified reverse bias condition,	Imd		○		○	○	○
Leak current characteristics of LD and PD	LD forward bias voltage vs. LD leak current,	Vf-I	○		○			
	LD reverse bias voltage vs. LD leak current,	Vr-I	○		○			
	PD forward bias voltage vs. PD leak current,	Vmf-I	○		○			
	PD reverse bias voltage vs. PD leak current,	Vmr-I	○		○			
Spectrum	Spectrum pattern		○		○			
	Center wavelength			○		○	○	○
	Bandwidth (width of half power point)			○		○	○	○
	Number of axis modes			○		○	○	○
	Symmetry			○		○	○	○
Luminous pattern	Far field pattern (FFP)		○		○			
	Half power angle			○		○	○	○
Other	Measuring temperature			○		○	○	○

● Statistical processing programming functions

- Repeated readout of data on floppy disk
- Output of processed data such as:
  Mean value
  Minimum value
  Standard deviation
  Frequency distribution chart

● Specifications (Measuring section)

LD current driver	LD drive mode	DC (CW)	Applicable to all measuring items
		Pulse driven. Pulse width: 0.5, 1, 2, 4 μs, Duty: 0.1%	Applicable to I-L measurement
	LD drive current	DC: 0 to 500 mA. Resolution: 0.1 mA	
		Pulse: 0 to 800 mA. Resolution: 0.1 mA	
LD voltage measuring section (I-V)	Measuring range	0 to 10V range. Resolution: 0.1 mV	
Optical power measuring section (I-L)	Wavelength range	0.6 to 1.6 μm	
	Optical power measuring range	0 to 100 mW range. Resolution: 10 μW	
		0 to 10 mW range. Resolution: 1 μW	
		0 to 1 mW range. Resolution: 0.1 μW	
LD leak current measuring section	Bias voltage setting range	0 to 20 V. Setting resolution: 10 mV	
	Leak current measuring range	0 to 200 μA. Resolution: 10 nA	
Spectrum measuring section	Wavelength rang	0.6 to 1.6 μm	
	Wavelength resolution	0.1 nm	
FFP measuring section	Wavelength range	0.6 to 1.6 μm	
	Measurement angle range	For horizontal, vertical: −60°C to +60°C, Angle resolution: 0.25°	
PD monitor current measuring section	Measuring range	0 to 4 mA range. Resolution: 2 μA	
		0 to 2 mA range. Resolution: 1 μA	
	Reverse bias voltage	0 to 30 V. Setting resolution: 20 mV	
PD dark current and leak current measuring section	Measuring range	0 to 200 μA range. Resolution: 100 nA	
		0 to 20 μA range. Resolution: 10 nA	
		0 to 2 μA range. Resolution: 1 nA	
		0 to 0.2 μA range. Resolution: 0.1 nA	
	Bias voltage	0 to 30 V. Setting resolution: 20 mV	
Temperature control	Setting range	0 to +70°C. Setting resolution: 0.1°C	
	Setting accuracy	±0.5°C	
Number of LD measurement channels		Max. 10 channels	

Note: It is possible to specify the LD drive current setting step and current range by program; the maximum specification is 1000 points.

● Specifications (General)

Ambient temperature, rated range of use		+10 to +30°C	
Power		AC **V ±10% 50/60 Hz, ≦1 kVA	
Dimensions	Control station	1500H, 600W, 750D mm	
	Test station	1500H, 900W, 750D	

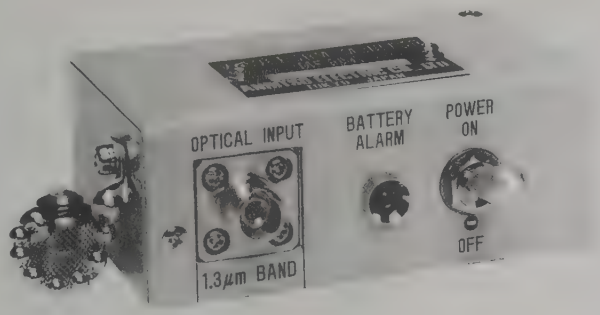
**Specify the power supply voltage (designated above as **V) between 100 V and 250 V.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	System		
ME9002A	Automatic LD Test System		
	Components		
DDC7707A	Packet IIIs Personal Technical Computer:	1	
DEU7775A	GP-IB Interface:	1	
DMM7763A	1MB RAM:	1	
DPR7713B	Printer:	1	
MS9001A	Optical Spectrum Analyzer:		
7550A	Plotter:	1	
	LD Test Bench:	1	
	LD Test Mount:	1	
	Rack:	1	For control station
	Rack:	1	For test station
	Standard accessories		
	Packet IIIs' system disk:	1 set	2 disks/set
	Measurement program for ME9001A:	1 set	2 disks/set
	Statistical processing program for ME9001A:	1 set	2 disks/set
	ME9002A Instruction Manual:	1	
	Packet III/IIIs Instruction Manual:	1	
	DPR7713B Instruction Manual:	1	
	MS9001A Instruction Manual:	1	
	7550A Instruction Manual:	1	
J0008	GP-IB cables, 2 m:	3	408JE-102
J0009	GP-IB cabel, 4 m:	1	408JE-104
J0017	Power cords, 2.5 m:	4	One each for Packet IIIs, MS9001A, 7550A and test bench
	Power cord:	1	For whole system
	Power cord:	1	For CRT
	Video cable for CRT display:	1	
	Fuse for Packet IIIs, 4 A:	2	
	Fuse for DPR7713B, 2 A:	1	
	Fuse for MS9001A, 5 A:	1	
	Fuse for 7550A, 1.5 A:	1	
	Fuse for test bench, 5 A:	2	
J0017	Power source key for MS96A	1	
Z0010	Paper:	1 set	Stockforms 4- to 10-inch paper
Z0077	Floppy disk:	1 set	For work, 10 disks/set
	Plotter pens:	1 set	One each of block, red, blue, green and yellow (for conventional paper)
	Plotter pens:	1 set	Black, 5 pcs/set
	Pen cursor:	1	

Waveform Monitor
MP95A/MP96A



MP96A

Features

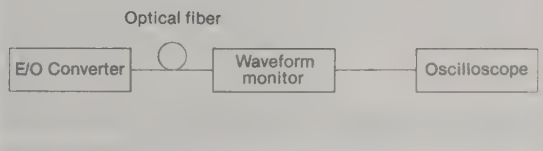
- Rise and fall time of less than 500 ps meets requirement for high-speed response.
- Internal battery operation with an alarm when voltage is low.
- Light power checks possible.
- Compact, lightweight.

Description

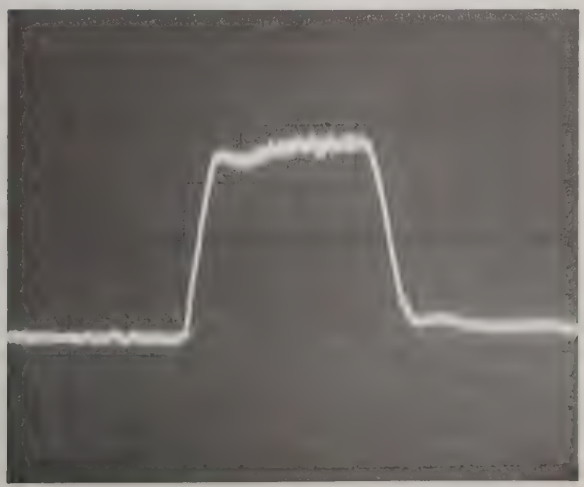
The Waveform Monitor is an easy-to-use O/E converter that can convert optical input baseband signals from DC to high frequencies, into an electrical signal.

Applications

- Waveform observation of a baseband signal employing an oscilloscope.
- Testing baseband frequency characteristics in conjunction with an oscillator, receiver, and an E/O converter.



Composition of waveform observation system



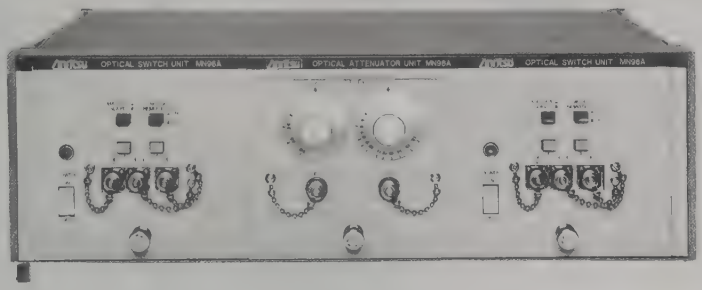
Specifications

● **MP95A/MP96A**

Model	MP95A	MP96A
Wavelength	0.5 to 1.1 μm	1.0 to 1.6 μm
Rise/fall time	<2 ns	<500 ps
Optical input diameter	240 μmϕ	100 μmϕ
Maximum input power (Peak)	0 dBm	−10 dBm
Output level	>2 mV (input: −10 dBm at 0.85 μm)	>3.5 mV (input: −10 dBm at 1.3 μm)
Optical connector*1	FC type	
Electric connector	SMA 50 Ω	
Built-in batteries	Lithium battery LF − 1/2 V (3 volts) × 6, May be used for 700 hours	
Dimensions and weight	27H, 69W, 40D mm, <150 g	

*1 The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.

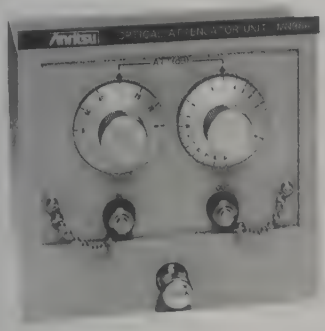
Optical Attenuator Unit
MN98A/MN911A/MN912A/MN913A/MN932A



MZ105 + MN98A + two units of MN96A

Features

Economical since general purpose applications are permitted by simply exchanging or adding appropriate units.



MN98A

Applications

- Input level adjustments
- Optical fiber loss measurements
- Evaluation of optical communication system characteristics

Description

This Optical Key Box Series uses plug-ins so that general purpose applications can be performed.
The key boxes consist of main frame MZ105A and function units (optical switch, branch/coupling and optical attenuator units) for both 0.85μm and 1.3μm bands. Any combination of 3 function units can be accommodated in the MZ105A.

Features

MN98A/MN911A

- Accurate attenuation over a wide range of wavelengths by employing evaporated metal film resistors.
- Any desired attenuation by combining a step attenuator and a continuously variable attenuator.

MN912A/MN913A

- The absorbing filters provide stable attenuation regardless of light source.

MN932A

- Employment of wideband filters enables using in both 1.3μm and 1.5μm bands.
- Combined step attenuator and continuous attenuator elements provide any desired attenuation value

Description

MN98A (0.85μm) and MN911A (1.3μm) are modular versions of the MN95A and MN95B respectively. The MN912A (0.85μm) and MN913A (1.3μm) employ the absorbing filters. The MN932A is built specifically for use with single-mode optical fibers. These units are used as plug-in variable optical attenuator in the MZ105A Main Frame.

Specifications

● MN98A/MN911A

Model	MN98A		MN911A
Wavelength	0.85μm		1.3μm
Maximum attenuation	65dB		
Attenuator elements composition	10dB × 5, continuously variable from 0 to 15dB		
Accuracy	10dB step att.	Continuously variable att.	Accuracy
	0dB	at 5, 10, 15dB	±1.0dB
	10dB	—	
	20dB		
	30dB		±2.0dB
	40dB		
	50dB		±2.5dB
Insertion loss	<3.5dB		
Input/output connector	FC type*1		
Compatible fiber	GI (50/125μm)		
Dimensions and weight	126H, 131W, 73Dmm, <1.5kg		

*1 The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.

● MN912A/MN913A

Model	MN912A		MN913A
Wavelength	0.85μm		1.3μm
Maximum attenuation	39dB		
Attenuator elements composition	0 to 9dB (in 1dB step)		
Accuracy	10dB step att.	1dB step att.	Accuracy
	0dB	0 to 9dB	±0.5dB
	10dB	—	±1.0dB
	20dB		±1.5dB
	30dB		±2.0dB
Insertion loss	<2.5dB		
Input/output connector	FC type*1		
Compatible fiber	GI (50/125μm)		
Dimensions and weight	126H, 131W, 73Dmm, <3kg		

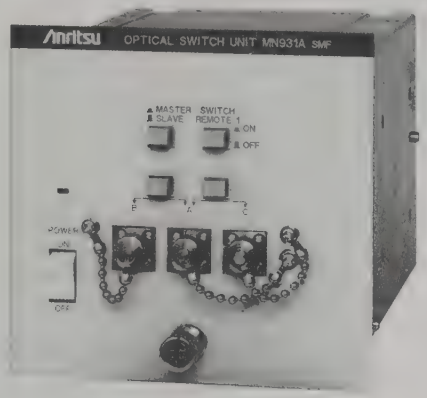
*1 The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.

● MN932A

Model	MN932A		
Wavelength	1.3μm, 1.55μm		
Maximum attenuation	65dB		
Configuration	10dB × 5, continuously variable 0 to 15dB		
Attenuation accuracy (0 to 50°C)	10dB step att.	Variabl att.	Accuracy
	0dB	5, 10, 15dB	±0.5dB
	10dB	0dB	±1.0dB
	20dB		
	30dB		±2.0dB
	40dB		
	50dB		±3.0dB
Input to output crosstalk	>70dB (at ∞ position in 10dB step att. setting)		
Insertion loss	≦3.5dB		
Input/output connector	FC type*1		
Compatible fiber	SM(10/125μm)		
Dimensions and weight	126H, 131W, 172Dmm, ≦2.5kg		

*1 The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.

Light Switch Unit
MN96A/MN99A/MN931A



MN931A

Features

- Precision switching mechanism ensures uniform switching characteristics.
- With a large isolation of more than 55dB a large optical S/N ratio can be obtained.

Applications

- Optical switching
- As a switch for comparison measurements

Description

- The MN96A (0.85μm) and the MN99A (1.3μm) are plug-in modules for use in the MZ105A Main Frame.

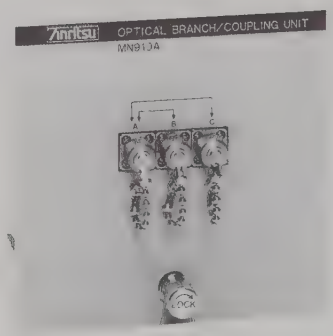
Specifications

- MN96A/MN99A/MN931A

Model	MN96A	MN99A	MN931A
Wavelength	0.85μm	1.3μm	1.3μm
Insertion loss	≦3dB		≦3dB
Isolation	≧55dB		≦65dB
Switching uniformity	≦0.05dB		≦0.15dB
Switching time	≦10m sec		≦10ms
Switching life	≧10^5 times		≧10^5 times
Input/output connector	FC type*1 (GI)		FC type*1 (SM)
Compatible fiber	GI (50/125μm)		SM (10/125μm)
Dimensions and weight	126H, 131W, 178.5Dmm, <1kg		126H, 131W, 178.5Dmm, <1.5kg

*1 The optical connector of the standard products is FC. Consult us should you need modification of the optical connector.

Optical Branch/Coupling Units
MN97A/MN910A



MN910A

Features

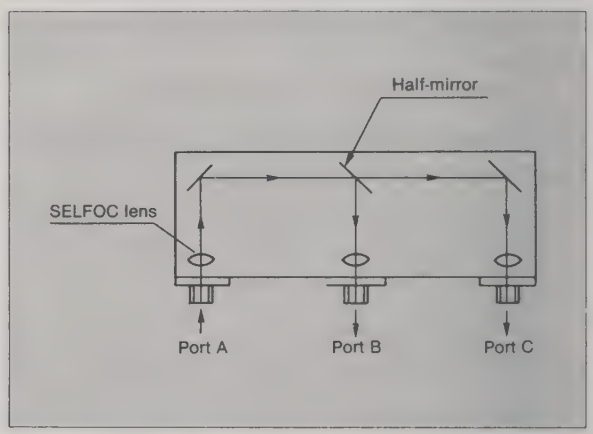
- Stable against vibration and shock
- Low insertion loss

Description

The MN97A (0.85 μm) and the MN910A (1.3 μm) are used for splitting or combining of optical signals. By inserting the plug-in modules into the MZ105A Main Frame, optical key boxes can be made.

Construction and Method of Operation

The input light from the port A is collimated by the lens and split by the half-mirror to port B and port C. In the opposite direction, if light from port B and port C are input, then the combined light will be output at port A.



Specifications

- **MN97A/MN910A**

Model	MN97A	MN910A
Wavelength	0.85 μm	1.3 μm
Insertion loss	≦5 dB between port A and B ≦5 dB between port A and C	
Loss difference	≦1 dB between port A to B and port A to C	
Isolation	≧15 dB between port B and C	
Optical connector	FC type*1	
Compatible fiber	GI (50/125 μm)	
Dimensions and weight	120H, 125W, 50D mm, ≦1 kg	

*1 The optical connector of the standard products is FC. Consult us should you need modification of the optical connector.

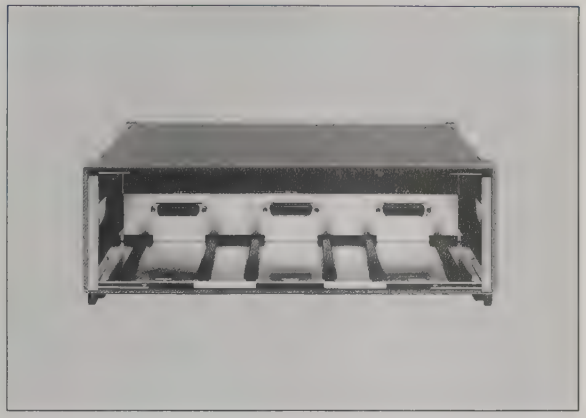
Main Frame
MZ105A

Features

By exchanging and adding units, it can be used for many applications.

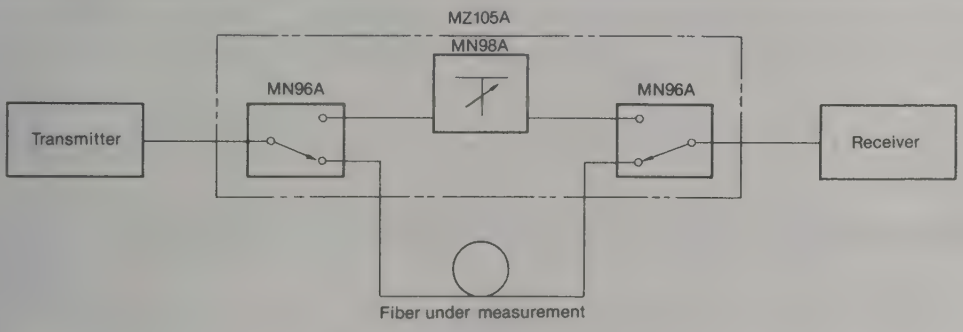
Description

The MZ105A is used as a power source for the optical switch unit (MN96A/MN99A). Any three of the following units can be accommodated at the same time, the MN98A/MN911A and MN912A/MN913A Variable Optical Attenuators and the MN97A/MN910A Optical Branch/Coupling Units.
By plugging in the optical attenuator units and the optical switch units, an optical key box configuration can be made.



Applications

Optical key box
As a plug-in system is employed, a variety of measurement applications can be performed by combining the appropriate optical units. A key box configuration is possible by plugging long wavelength and short wavelength band function units into the MZ105A.



Composition of optical loss measurement system

Specifications

● MZ105A

Number of units to be accommodated	3
Dimensions	133H, 426W, 350D mm
Power*	AC 100 V ±10 %, 50/60 Hz, <20 VA
Weight	≤6 kg

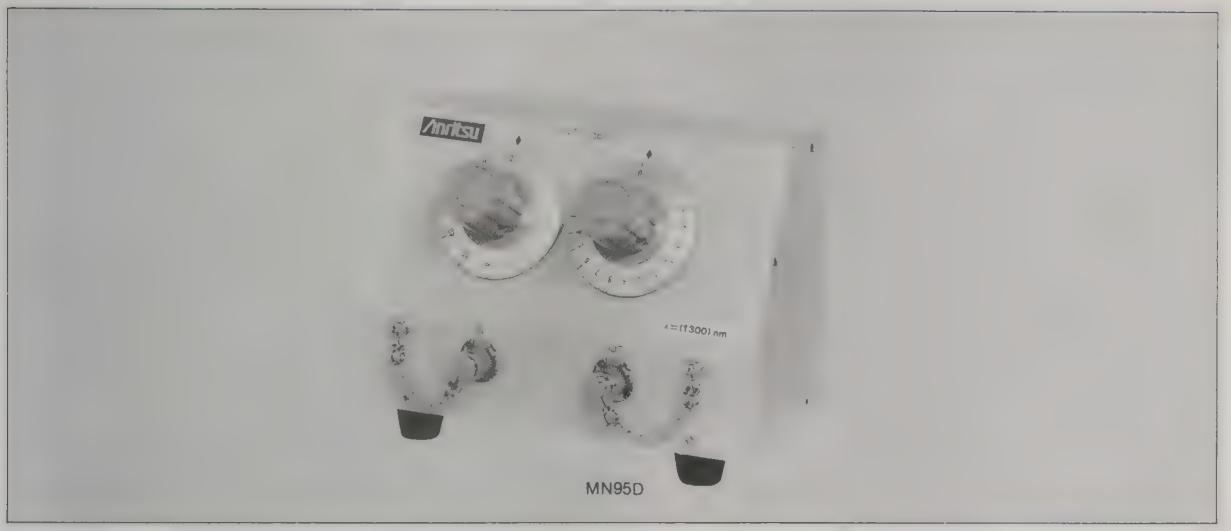
* Specify one nominal AC line voltage between 100 V and 250 V when ordering.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MZ105A	Optical Key Box Main Frame		
	Plug-in units		
MN98A	Optical Attenuator Unit		0.85 μm band
MN911A	Optical Attenuator Unit		1.3 μm band
MN912A	Optical Attenuator Unit		0.85 μm band
MN913A	Optical Attenuator Unit		1.3 μm band
MN932A	Optical Attenuator Unit		1.3/1.55 μm band
MN96A	Optical Switch Unit		0.85 μm band
MN99A	Optical Switch Unit		1.3 μm band
MN931A	Optical Switch Unit		1.3 μm band
MN97A	Optical Branch/Coupling Unit		0.85 μm band
MN910A	Optical Branch/Coupling Unit		1.3 μm band
	Standard accessories		
J0017	Power cord, 2.5 m:	1 pc	
	Fuse for MZ105A, 1 A:	1 pc	MF51NN250V1AAC05
	MZ105A Operation manual:	1 copy	
	Operation manual of each unit:	1 copy	Supplied with each unit

Optical Variable Attenuator
MN95C/MN95D



MN95D

Features

- Stable accuracy: The metallic film assures a wide range of usable wavelength and stable accuracy.
- Prevention of multiple reflection:
  The use of a metallic film risks incident light again by reflection and multiple reflection, but these are prevented by giving an angle to the filter against the optical axis.
- Low insertion loss.
- Small dimensions and light weight.

Description

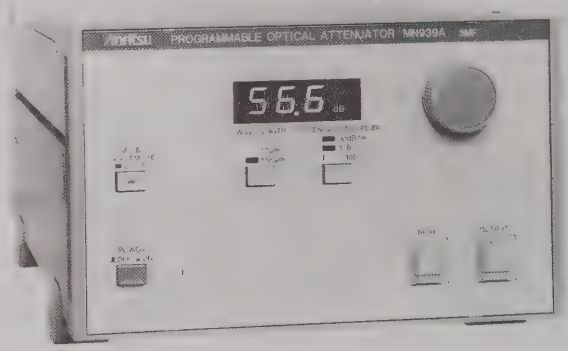
The optical variable attenuator passes an optical signal from a light emitting element through an optical fiber via a lens through an attenuating filter in order to reduce it to an appropriate light power output.
This optical variable attenuator is a reflection type using a metallic film. Two different models are available. The MN95C is used at 0.85μm band and the MN95D at 1.3μm band.
The MN95C and MN95D can be used either in continuous variation or variation in steps.

Specifications

- **MN95C/MN95D**

Model	MN95C	MN95D
Wavelength	0.85μm band	1.3μm band
Maximum attenuation	65dB	
Attenuator composition	10dB × 5, continuously variable 0 to 15dB	
Attenuation accuracy	±0.5dB (step att. at 0dB; continuously variable att. at 0, 5, 15dB) ±1.0dB (step att. at 10, 20dB; continuously variable att. at 0dB) ±2.0dB (step att. at 30, 40dB; continuously variable att. at 0dB) ±2.5dB (step att. at 50dB; continuously variable att. at 0dB)	
Input to output crosstalk	>70dB (at∞position in 10dB step att. setting)	
Insertion loss	<2.5dB	
Optical input/output connector	FC type	
Dimensions	95H, 135W, 70D mm	
Applicable fiber	Multi-mode fiber (50/125μm, NA 0.2)	
Ambient temperature, rated range of use	0 to 40°C	
Weight	<1kg	

Programmable Optical Attenuators
MN938A/MN939A



MN939A

《GP-IB》

Features

- Wide attenuations range: 0 to 60 dB
- Digital display in a step of 0.1 dB
- Applicable for two wavelengths by switch selection

Applications

As an ATE system component, the MN938A/MN939A can perform:

- Error rate measurement
- Adjustment on receiving level at the time of transmission characteristics measurement.
- Measurement on optical fiber loss
- Measurement on multicore fiber characteristics by using in combination with optical channel selector (MN936A/MN937A)

Descriptions

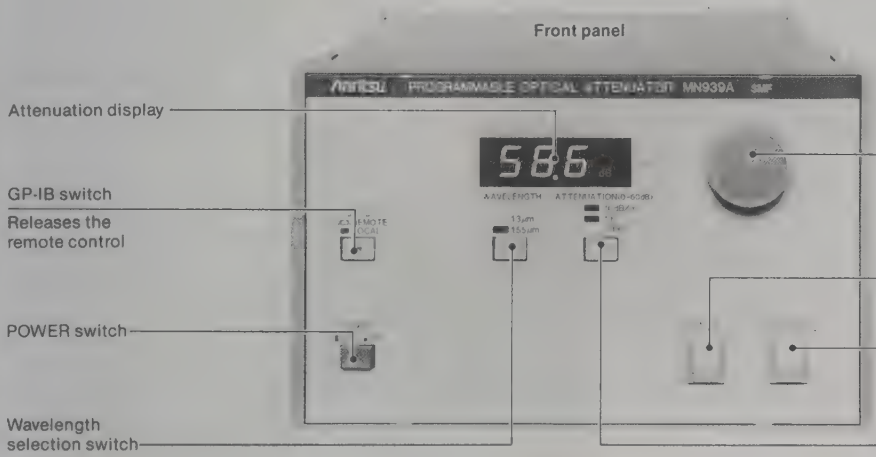
MN938A/MN939A are optical attenuators which can set attenuation in a range of 0 to 60 dB in 0.1 dB step. It can be used in 2 wavelengths by switch selection. As these units are provided with GP-IB as standard, it can be used in a variety of automatic measuring systems in such departments as development, production and inspection. By adoption of a rotary encoder, it is possible to set an attenuation smoothly even when used manually.

Specifications

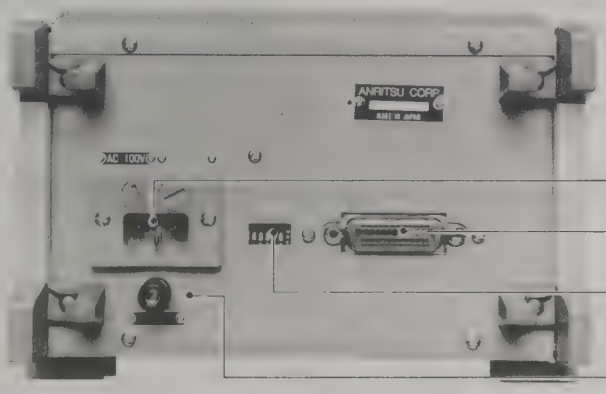
Model	MN938A	MN939A
Wavelength	0.85 μm/1.3 μm	1.3 μm/1.55 μm
Optical fiber to be measured	GI (50/125 μm)	SM (10/125 μm)
Maximum attenuation	60 dB/∞ position	
Insertion loss	≦3.5 dB	
Minimum attenuation step	0.1 dB	
Switching repeatability	±0.1 dB	
Switching time	500 ms	
Attenuation accuracy	±0.5 dB (±0.7 dB at 1.55 μm)	
Input to output crosstalk	>70 dB (at ∞ position in 10 dB step att. setting)	
Ambient temperature, rated range of use	0 to 50°C	
Optical input/output connector	FC type	
Power	100 V ±10%, 50/60 Hz, ≦45 VA	
Dimensions and weight	132.5 H, 213 W, 350 D mm, ≦7 kg	

Note: The standard optical connector is FC type. Please contact us for changing of optical connectors.

Front panel

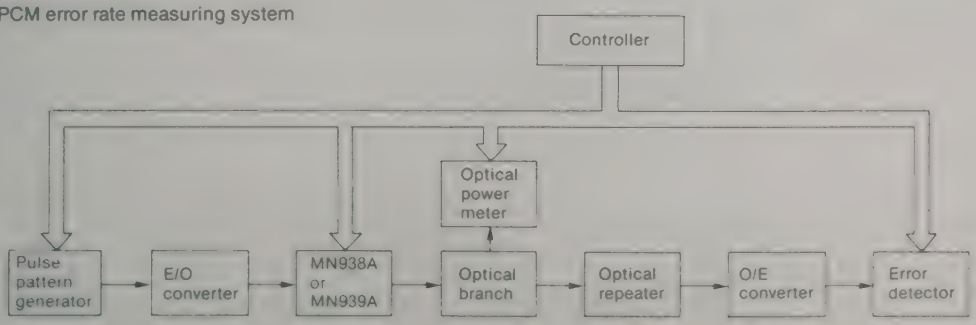


Rear panel



Application example

PCM error rate measuring system



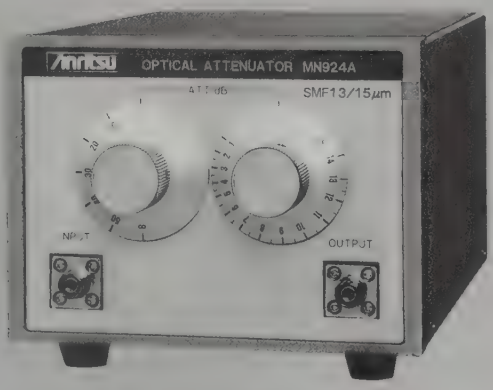
Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MN938A	Programmable Optical Attenuator		
MN939A	Programmable Optical Attenuator		
	Standard accessories		
J0017	Power cord, 2.5 m:	1 pc	
	Fuse for MN938A/MN939A, 2 A:	2 pcs	T2A250V
	MN938A/MN939A Operation manual:	1 copy	

Optical Attenuator
MN924A/MN934A/MN935A

● For SM fiber



MN924A

Features

- Suitable for 1.3μm and 1.55μm wavelengths. Attenuation filter with wide wavelength range and flat characteristics permit 1.3μm and 1.55μm wavelengths to be covered by a single unit. (MN924A)
- Angled filter prevents multiple reflections

Description

The MN924A/MN934A/MN935A are high-precision optical attenuators designed for use with single-mode optical fiber. A combined step attenuator and continuous attenuator permit highly accurate attenuation adjustment.

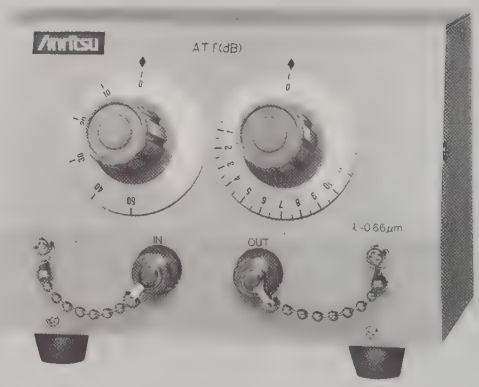
Specifications

Model	MN924A	MN934A	MN935A
Compatible fiber	SM (10/125μm)		
Wavelength	1.3μm, 1.55μm	1.3μm	1.55μm
Maximum attenuation	65dB		
Configuration	10dB×5, continuously variable 0 to 15dB		
Attenuation accuracy (0 to 50°C)	±0.5dB (step att. at 0dB; continuously variable att. at 5, 10, 15dB) ±1.0dB (step att. at 10, 20dB; continuously variable att. at 0dB) ±2.0dB (step att. at 30, 40dB; continuously variable att. at 0dB) ±3.0dB (step att. at 50dB; continuously variable att. at 0dB)		
Input to output crosstalk	>70dB (at∞position in 10dB step att. setting)		
Insertion loss	≦3.5dB		
Input/output connector	FC type*		
Dimensions and weight	88H, 120W, 172D mm, <2kg	88H, 120W, 172D mm, <2.5kg	

* FC connectors are standard. For other connector type, consult Anritsu.

Optical Attenuator
MN925A

- **For visible light**



Features

- **High NA lens**
  A 0.52NA lens permits leak-free transmission of light even from 1mm plastic fibers, ensuring accurate attenuation.
- **Prevents multiple reflection**
  The angle of the filter has been tilted with respect to the optical axis. This prevents reentry of reflected rays of light, eliminating the possibility of multiple reflection.

Description

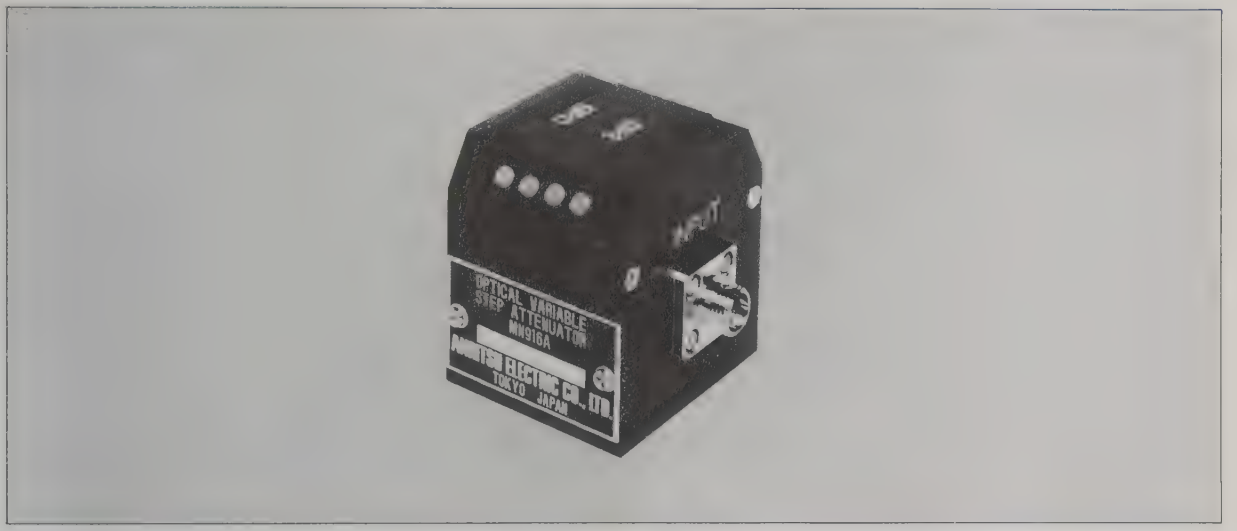
The MN925A is an optical attenuator employing reflective metallized filter designed for the visible spectrum. Step and variable filters are combined, providing wide range of continuous adjustment.

Specifications

Wavelength	0.66μm
Maximum attenuation	65dB
Configuration	10dB×5, continuously variable 0 to 15dB
Attenuation accuracy (0 to 40°C)	±1.0dB (step att. at 0dB; continuously variable att. at 5, 10, 15dB) (or step att. at 10, 20dB; continuously variable att. at 0dB) ±2.0dB (step att. at 30, 40dB; continuously variable att. at 0dB) ±2.5dB (step att. at 50dB; continuously variable att. at 0dB)
Insertion loss	≦3.5dB
Input/output connector	FC type*
Compatible fiber	Plastic fiber (1mm core dia. 0.5 NA)
Dimensions and weight	95H, 135W, 70D mm, <1kg

* FC connectors are standard. For other connector type, consult Anritsu.

Optical Variable Step Attenuator
MN916A/B



Features

- Compact and lightweight for portability
- 9 different attenuation levels can be set by simple operation
- Countermeasures for multiple reflection
- Absorbing filter used for stable attenuation regardless of light source

Description

The optical variable step attenuator MN916A/B employs an absorbing filter for high levels of accuracy and stability. Nine different levels of attenuation can be selected by using two attenuator elements in combination.

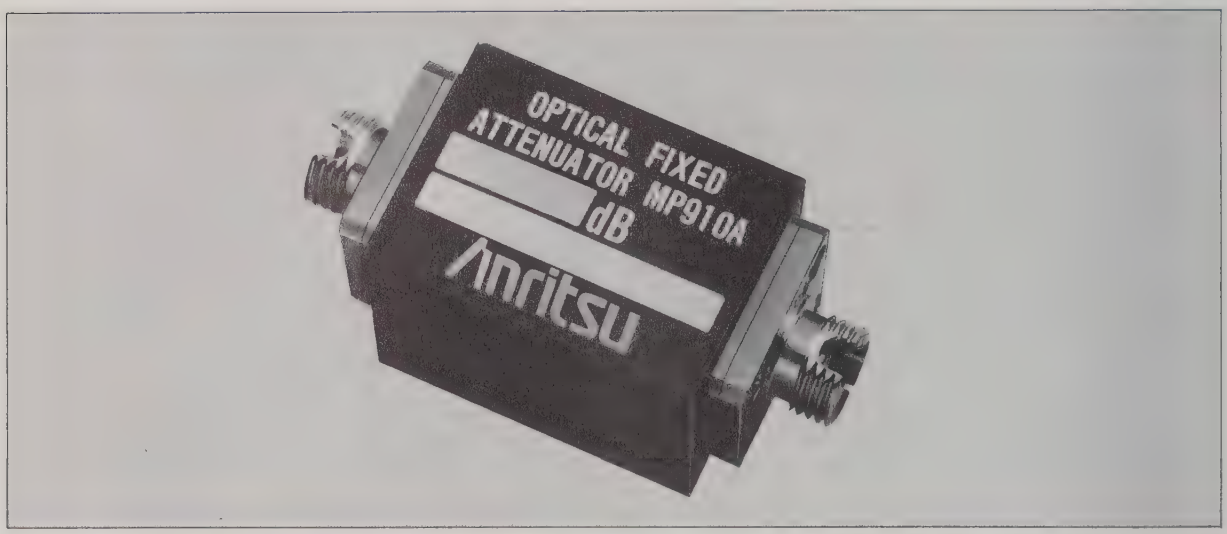
Specifications

- **MN916A/B**

Model	MN916A	MN916B
Wavelength	0.85 μm	1.3 μm
Attenuation accuracy (5 to 40°C)*1	(Attenuation and accuracy) : (Combination of attenuator element) 3dB ±0.5dB : 0dB, 3dB 6dB ±0.5dB : 3dB, 3dB 10dB ±0.5dB : 7dB, 3dB 13dB ±0.5dB : 0dB, 13dB 16dB ±0.7dB : 3dB, 13dB 20dB ±0.7dB : 7dB, 13dB 23dB ±0.5dB : 0dB, 23dB 26dB ±0.7dB : 3dB, 23dB 30dB ±1.0dB : 7dB, 23dB	
Connector*2	FC type	
Applicable fiber	Multi-mode fiber (50/125 μm, NA 0.2)	
Dimensions and weight	43H, 39W, 40D mm, ≤200 g	

*1 Attenuation value described above include attenuation of main frame.
*2 The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.

Optical Fixed Attenuator
MP910 □



Features

- Compact and lightweight for portability
- Countermeasures for multiple reflection

Description

The MP910□ is a compact and lightweight optical fixed attenuator employing an absorbing filter for a high degree of accuracy and stability.

Specifications

● MP910□

Model	Attenuation and accuracy (5 to 40°C, 0.85 μm)	Wavelength	Connector	Dimensions and weight
MP910A	3.0 ±0.5 dB	0.85 μm	FC type	21H, 20W, 26D mm, ≤30 g
MP910B	6.0 ±0.5 dB			
MP910C	10.0 ±0.5 dB			
MP910D	20.0 ±0.7 dB			
MP910E	30.0 ±0.8 dB			
MP910F	40.0 ±1.0 dB			

Notes: 1) Applicable fiber: Multi-mode fiber (50/125 μm, NA 0.2)
2) The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.

Optical Channel Selector
MN936A/MN937A

The Optical Channel Selector MN936A/MN937A can perform switching between one input and six outputs (or one output and six inputs). The principal component is a prism driven by an electromagnetic switch.
GP-IB capability is standard in the MN936A/MN937A, therefore it is highly suitable for use in automatic measuring systems in various application fields, including R&D, production line or product inspection.

Features

- Stable switching characteristics enable measured data to be thoroughly reproducible.
- Optical signals with high S/N ratio can be obtained, because of excellent I/O isolation of the MN936A/MN937A.

Applications

- Connection switching to measure transmission bandwidth or optical loss of multi-core optical fiber cable in the fields including R&D, production, inspection and maintenance.
- Connection switching to launch multiple light output from a multi-channel light source into an optical fiber.
- Optical route switching for LD or LED element characteristic measurement in the fields of R&D and production.
- Optical route switching for measurement of optical devices such as E/O modules.

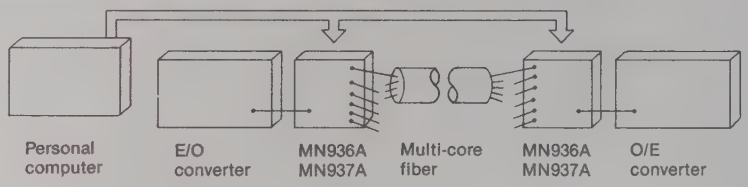
Specifications

Item \ Model	MN936A		MN937A	
Wavelength	0.85 μm	1.3 μm	1.3 μm	1.55 μm
Insertion loss	< 2.5 dB	< 2.0 dB	< 3.0 dB*	< 3.5 dB*
Crosstalk	> 50 dB		> 65 dB	
Switching uniformity	< 0.02 dB		< 0.03 dB	
Switching time	< 10 ms		< 10 ms	
Life	> 10^6 times		> 10^6 times	
Compatible fiber	GI (50 μm core/125 μm clad)		SM (10 μm core/125 μm clad)	
Optical connector	FC type		FC type	
Ambient temperature, rated range of use	0 to 40°C		0 to 40°C	
Dimensions and weight	88 H, 213 W, 251 D mm, < 5 kg		88 H, 213 W, 251 D mm, < 5 kg	

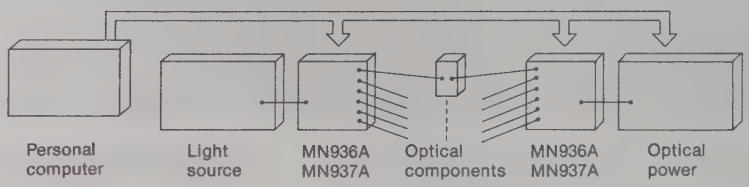
Note: Standard optical connector is FC type. For other connectors, please consult nearest Anritsu representative.
These values marked may be different value when equipped with optical connectors other than FC type.

Application examples

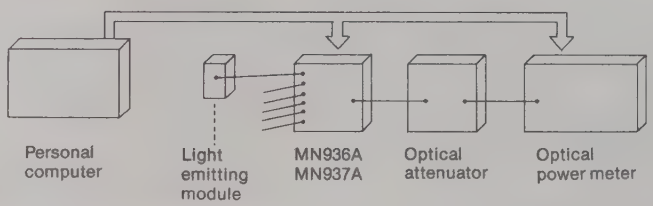
● **Automatic measurement on transmission characteristics of multi-core fiber**



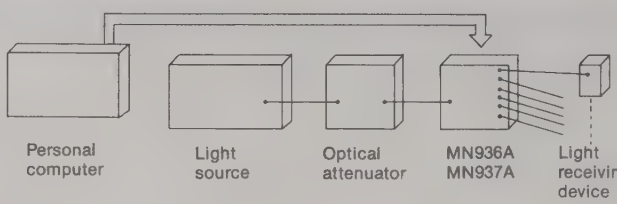
● **Automatic measurement on optical components**



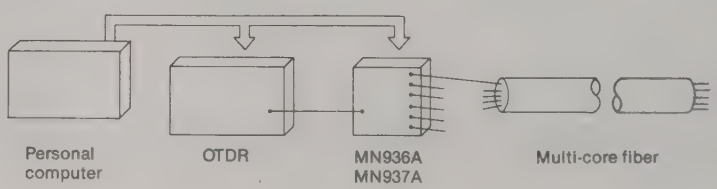
● **Automatic measurement on light emitting module**

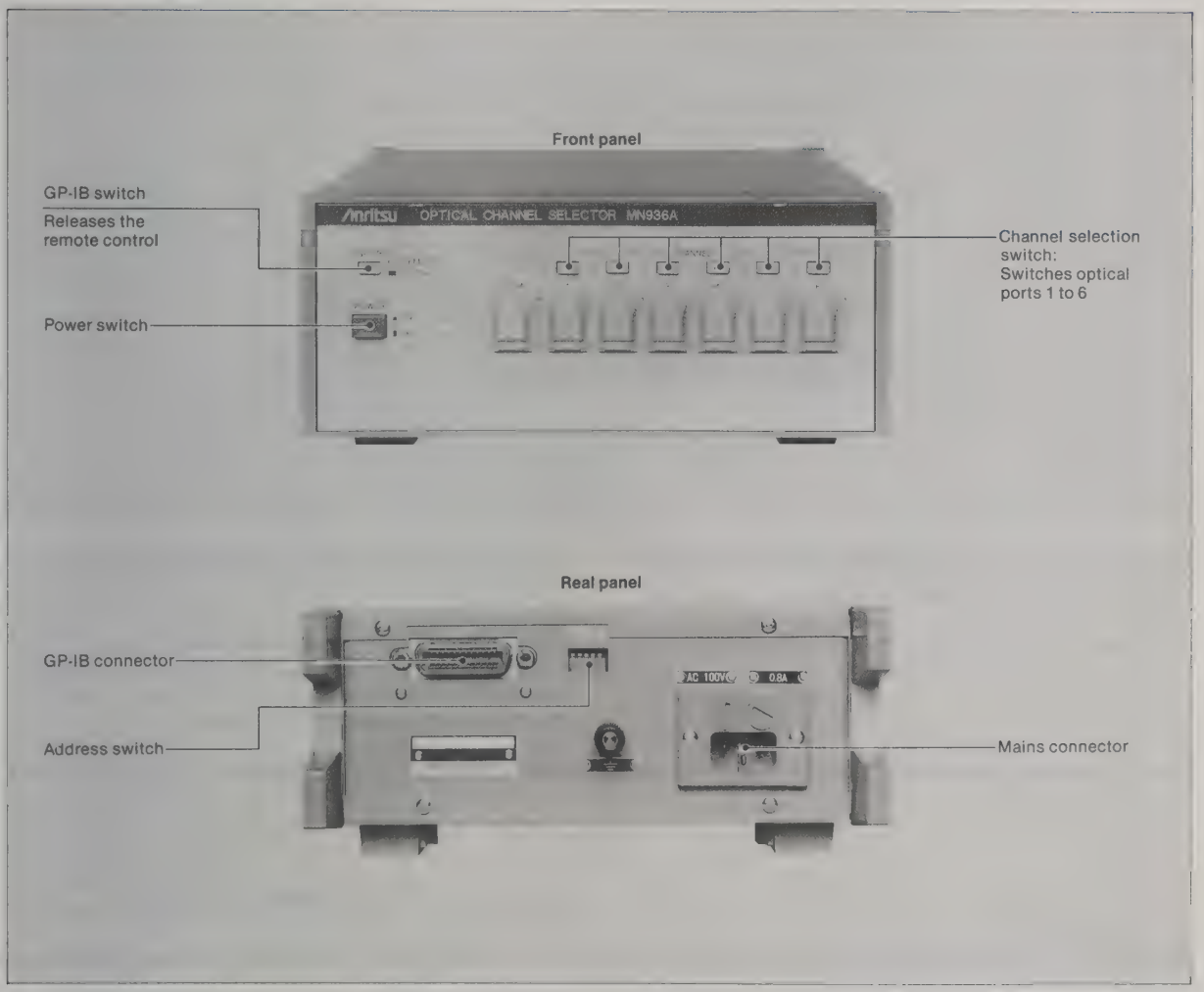


● **Automatic measurement on light receiving devices**



● **Automatic measurement on break point of multi-core fiber**



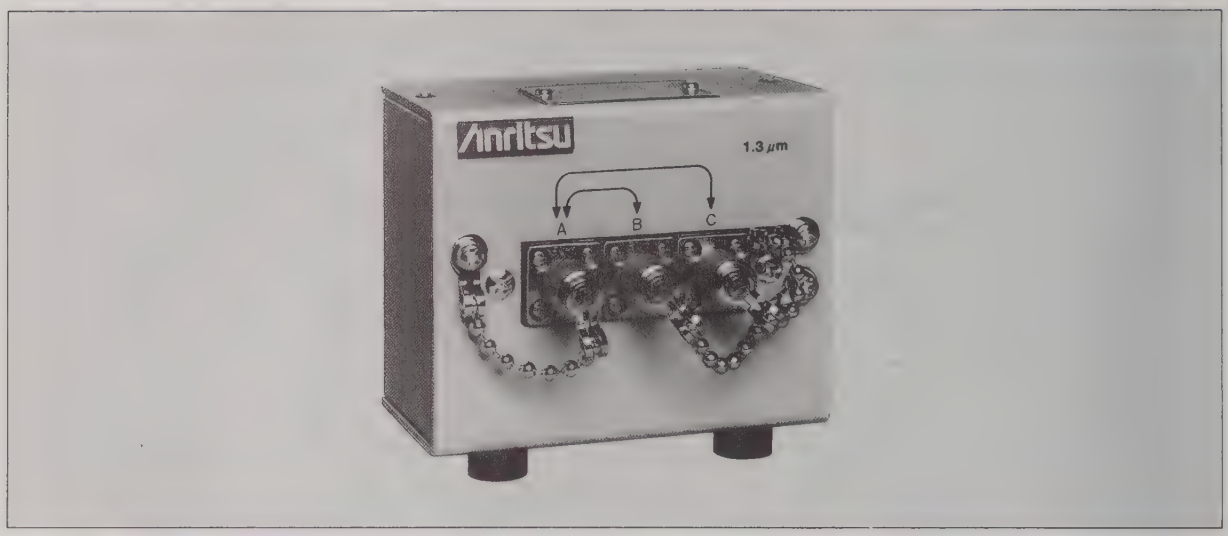


Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MN936A	Optical Channel Selector		For GI (50/125) fiber
MN937A	Optical Channel Selector		For SM (10/125) fiber
	Standard accessories		
J0017A	Power cord, 2.5 m:	1 pc	
	Fuse for MN936A, 0.8A:	2 pcs	MF51NN250V0.8AAC05
	Fuse for MN937A, 0.8A:	2 pcs	MF51NN250V0.8AAC05
	MN936A/MN937A Instruction Manual:	1 copy	

Optical Branch/Coupling
MN919A/MN920A



Features

- Highly stable and precise dividing ratio
- Low insertion loss
- Compact, lightweight

Description

The MN919A and MN920A are optical branch/coupling that can be used to divide or couple optical power. The principal component is a glass plate with a multilayer vapor-deposited dielectric. This design provides the uniform transmission/reflection ratio required for optical dividing and coupling applications.

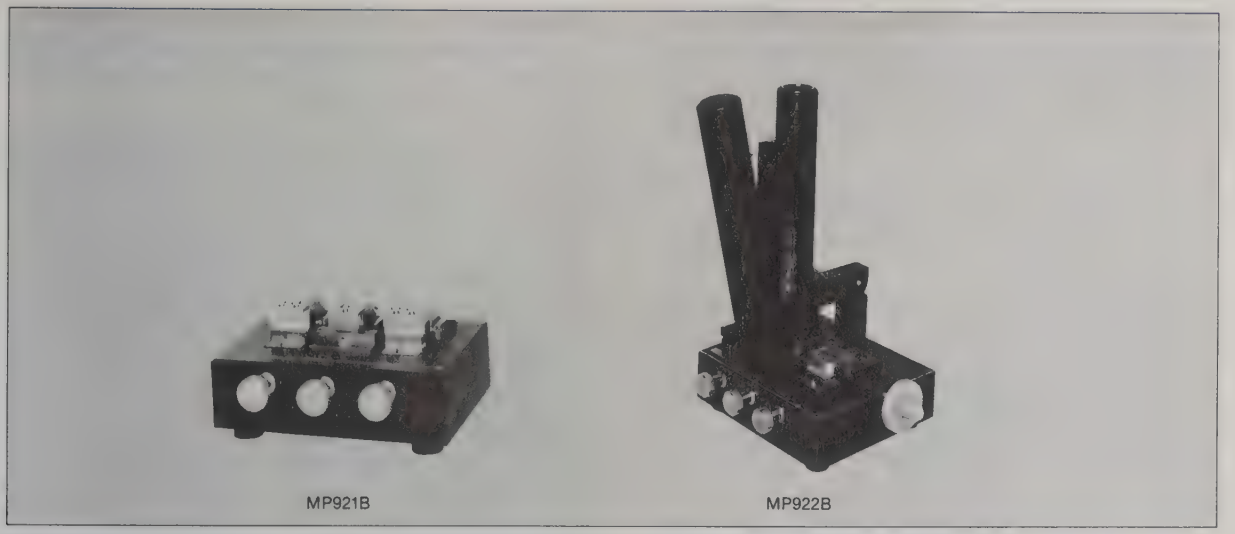
Specifications

- **MN919A, MN920A**

Model	MN919A	MN920A
Wavelength	0.85 μm	1.3 μm
Insertion loss	≦5 dB between port A and B, ≦5 dB between port A and C	
Loss difference	≦1 dB between port A to B and port A to C	
Isolation	≧15 dB between port B and C	
Optical connector	FC type	
Compatible fiber	GI (50/125 μm)	
Ambient temperature, rated range of use	5 to 40°C	
Dimensions and weight	80 H, 85 W, 45 D mm, >500 g	

*The optical connector of the standard product is FC. Consult us should you need modification of the optical connector.

Bare Fiber Connector
MP921B/MP922B



MP921B

MP922B

Features

Easy to use
These connectors can be used for easy, low-loss optical fiber connections. No special technical training is required.
Single-mode fiber applications
The MP922B controls the distance between optical fiber ends, enabling a highly practical, low-loss connection even for SM fibers.
A variety of fiber applications
Replacement of optical fiber jacket holder makes this connector usable for optical fibers with jacket diameters from 0.25 to 1.2 mm.
Portability
Both the MP921B and MP922B are encased for portability.

Description

The MP921B and MP922B are bare fiber connectors employing a V-shaped groove to temporarily connect optical fiber cores in short time. The MP922B's optical fiber connection part can be observed by microscope, permitting fine control of distance between optical fiber end-surfaces, and allowing low-loss single-mode fiber connection.

Specifications

Model	MP921B	MP922B	
Bare fiber diameter	50 μm core/125 μm clad	10 μm core/125 μm clad	50 μm core/125 μm clad
Compatible fiber	GI	SM	GI
Alignment loss	<0.2 dB*	<1 dB*	<0.2 dB*
Dimensions and weight	47 H, 90 W, 79 D mm, <0.7 kg	178 H, 119 W, 97 D mm, <0.9 kg	
Accessories supplied	One carrying case One bottle of matching oil Five cotton buds Five toothpicks	One carrying case One bottle of matching oil Five cotton buds Five toothpicks Two R-6 dry cells	

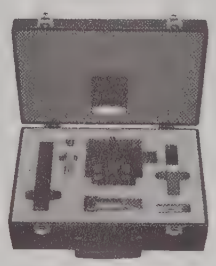
Note: The standard jacket holder is designed for optical fiber with a jacket diameter of 0.9 mm.
*: Using matching oil

Options

01 : Jacket holder for optical fiber with a jacket diameter of 0.25mm.
02 : Jacket holder for optical fiber with a jacket diameter of 0.4mm.

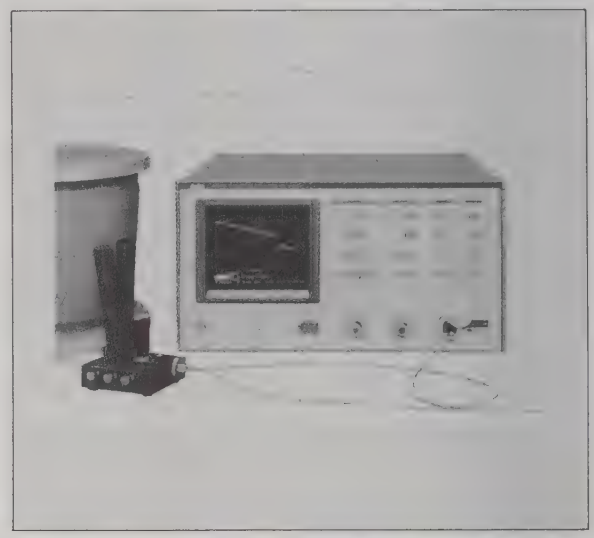
Note 1: For other jacket diameters than above, consult your nearest Anritsu Representative.
2: The fiber cleaver and MP924A Jacket Stripper are sold separately.

Carrying Case



Application example

The MP921B/MP922B can be used as connectors for measurement of fault position in optical fiber using the MW98A Optical Time Domain Reflectometer.



Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MP921B	Bare Fiber Connector		
MP922B	Bare Fiber Connector		
	Standard accessories of MP921B		
Z0049	Matching oil:	1 bottle	3cc
Z0050	Cotton bud:	5 pcs	
Z0051	Toothpick:	5 pcs	
B0131A	Carrying case:	1 pc	
	MP921B Operation manual:	1 copy	
	Standard accessories of MP922B		
Z0049	Matching oil	1 bottle	
Z0050	Cotton buds	5 pcs	
Z0051	Toothpick	5 pcs	
B0131B	Carrying case	1 pc	
G0017	R-6 dry cell	2 pcs	For microscope
	MP922B Operation manual	1 copy	
	Options		
MP921B-01	0.25mm Jacket holder		
MP922B-01	0.25mm Jacket holder		
MP921B-02	0.4mm Jacket holder		
MP922B-02	0.4mm Jacket holder		
	Optional accessories		
MP924B	Fiber core stripper		
Z0052	Fiber cutter		

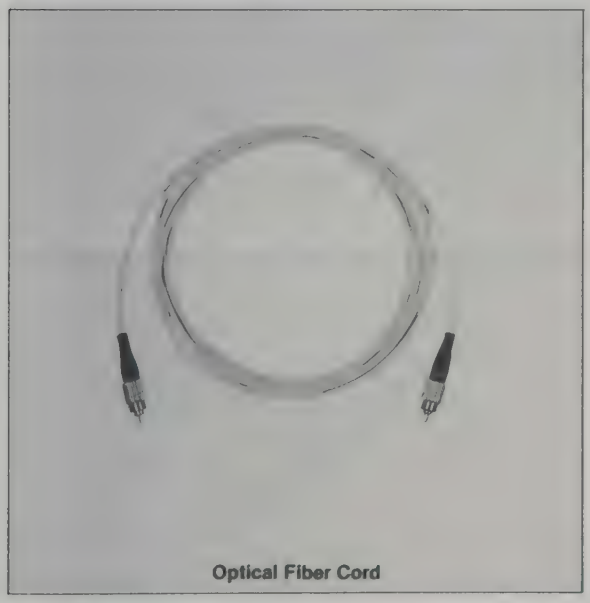
Anritsu offers a full line of accessories for use with optical communications measuring equipment.

Optical fiber cord/adaptor

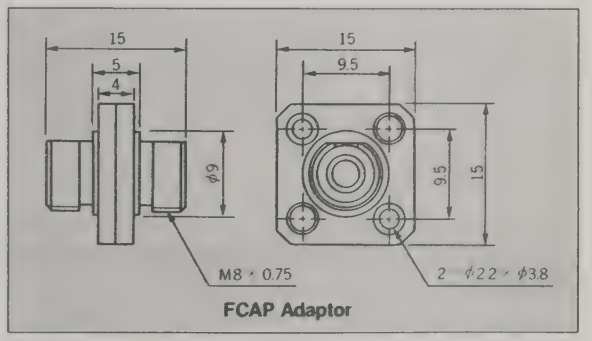
Optical fiber cord and adaptor are used during optical communications measurements to permit connection between two measuring instruments, between instruments and fibers, or between two fibers.

Model	Insertion loss at 0.85μm wavelength	Connector	Applicable fiber
FC-[*1]-[*2]M-GI Optical fiber cord	<0.7dB (one end)	FCAP, FC-R	Multi-mode fiber (50/125μm, NA 0.2)
FC-[*1]-[*2]M-SM Optical fiber cord	<0.7dB (one end)	FCAP, FC-R	Single-mode fiber (10/125μm, NA 0.1)
FC-D4-[*2]M-GI	<0.7dB (one end)	FCAP, FC-R: A plug on one end D4: A plug on one end	Multi-mode fiber (50/125μm, NA 0.2)
FCAP Adaptor	<0.7dB	FC-P	Multi-mode/ Single-mode fiber

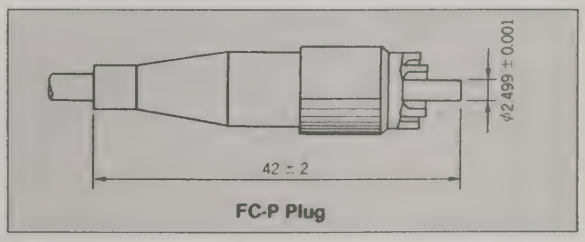
*1 "1" indicates a plug on one end, "2" indicates a plug on both ends.
*2 This indicates fiber cord length in meters. Specify length as 1, 2 or 3 meters.
Note: FCAP is an FC-type adaptor, FC-P is an FC-type plug, FC-R is an FC-type receptacle.



Optical Fiber Cord



FCAP Adaptor



FC-P Plug

Dummy fiber for optical loss measurements

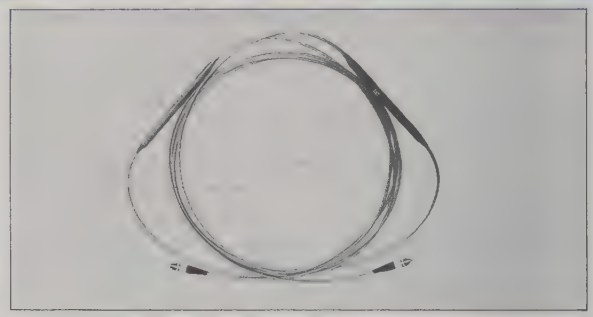
This is a dummy fiber used in optical loss measurements to excite the normal propagation mode of the light.

Insertion loss	Applicable connector	Manufacturer
<8dB	FC-P	Sumitomo Electric Industries, Ltd., Fujikura Ltd., The Furukawa Electric Co., Ltd.

Optical Fiber Cord for Baseband Measurements

This is a fiber used in measuring baseband characteristics to excite the full mode of the light.

Insertion loss	Applicable connector	Manufacturer
<3dB	FC-P, FCAP	Sumitomo Electric Industries, Ltd., Fujikura Ltd., The Furukawa Electric Co., Ltd.

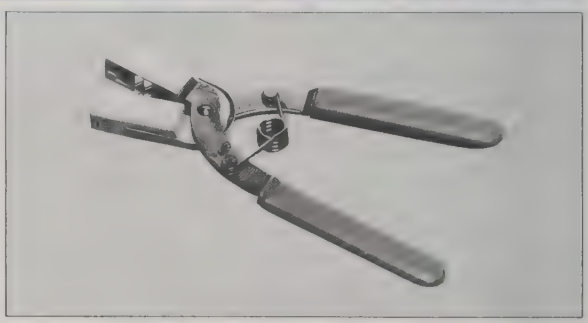


Optical Fiber Cutter

This device cuts optical fiber cord to produce a right-angle mirror-face break. It can be used with fiber cords produced by Sumitomo Electric Industries, Ltd., Fujikura Ltd., and Furukawa Electric Co., Ltd.

Jacket Stripper

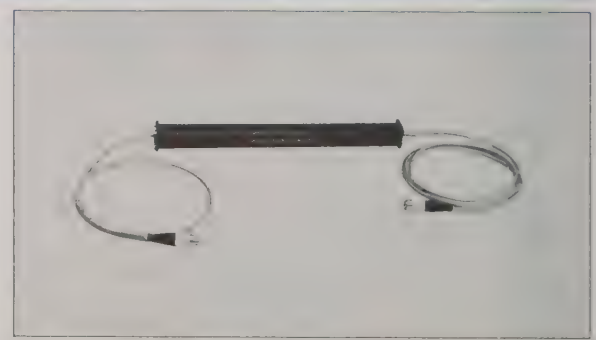
This tool is used to remove the nylon jacket from around the core assembly. It can be used with fiber cords produced by Sumitomo Electric Industries, Ltd., Fujikura Ltd. and Furukawa Electric Co., Ltd.



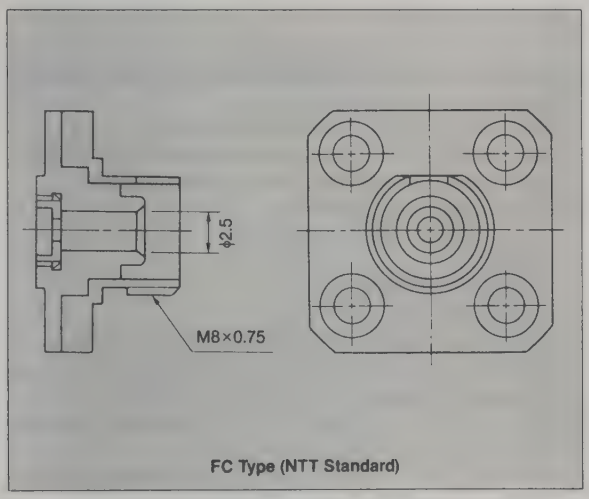
MZ106A Mode Scrambler

When measuring optical fiber loss or instrument insertion loss, this device is attached to LED light sources to insure a uniform injection mode.

Insertion loss	Connector
7 ±2dB	FCAP, FC-P



The following figure shows the construction of optical connector. Please refer to it before placing your order to assure connector compatibility.



FC Type (NTT Standard)

Error Rate Measuring Equipment
ME448A/B/C

- ME448A ..... PCM30 channels
- ME448B ..... PCM24 channels (B3ZS, B6ZS)
- ME448C ..... PCM24 channels (B8ZS)

《GP-IB》
OPTION

The Error Rate Measuring Equipment ME448A/B are small, easy-to-operate measuring instruments designed to measure binary errors by bit-by-bit detection in digital systems over 1kbit/s to 50Mbit/s (covered PCM hierarchy from 1st to 3rd order).
It is also useful for testing digital radio systems, digital line systems, digital multiplex and optical fiber equipment, both satellite and terrestrial.
The ME448A/B consist of two cabinets: the sending unit and the receiving unit. Consequently a single test set alone is capable of end-to-end and loop-back measurements of digital systems.
The sending unit transmits an M-sequence (maximum length sequence) pseudo-random pattern which is similar to that of the pattern of actual PCM signals.
The receiving unit receives the signal from a system under measurement, detects error pulses, counts their number and displays it. The result of the error rate measurement is displayed by a digital display for direct readout of the error rate.

Features

- Operating 1kbit/s to 50Mbit/s
- Loop-back and end-to-end measurements
- Most useful for testing digital radio systems, digital line systems, and optical fiber transmission systems.
  Bipolar: Maximum four outputs
  (two outputs standard)
  Unipolar:
  Pattern: four outputs
  Clock: two outputs
- Error rate measurement and error pulse counting by detecting binary bit errors or code violation errors (option)
- Sending unit, internal clock crystal oscillator:
  Maximum four frequencies installed
- Receiving unit, bipolar clock recovery:
  Maximum four frequencies installed
- Measuring pattern: Pseudo-random pattern
  maximum length $2^{15}-1$ or $2^{23}-1$ bits
- Measuring codes: ME448A AMI, HDB3
  ME448B AMI, B3ZS, B6ZS
  ME448C AMI, B8ZS
- Optional function that permits error rate measurement on live PCM line is available (code violation error measurement option)
- Recorder output/printer output
- GP-IB interface (option)

Specifications (sending unit)

Model		ME448A	ME448B	ME488C
Internal clock	Frequency	Any two frequencies from 100kHz to 50MHz (Specify the frequencies when placing your order)		
	Stability	Within ± 10ppm		
	One additional frequency (Option 11)	Any one additional frequency from 100kHz to 50MHz (Specify the frequency when placing you order)		
	Two additional frequencies (Option 12)	Any two additional frequencies from 100kHz to 50MHz (Specify the frequencies when placing your order)		
External clock	Operating frequency	1kHz to 50MHz		
	Input level	0.8 to 1.5Vp-p		
	Impedance	75Ω nominal to ground		
	Connector	BNC female		
Output pattern	Pseudo-random pattern	15 or 23 stages by switch selection (maximum length $2^{15}-1$ or $2^{23}-1$ bits)		
	Isolated pattern	1/63 (1 bit mark every 63 bits clock)		

Continued on next page.

Model		ME448A	ME448B	ME448C
Bipolar output pattern	Operating frequency	100kHz to 50MHz		
	Code Level	AMI, HDB3 2.37V0-p, 1.0V0-p by switch selection	AMI, B3ZS, B6ZS 2.0V0-p, 1.0V0-p by switch selection	AMI, B8ZS 2.0V0-p, 1.0V0-p by switch selection
	Load Number of outputs Attenuation Connector	75Ω nominal to ground 2 6dB ON, OFF by switch selection BNC female		
	Additional unbalanced bipolar output (Option 21) Number of outputs Other specifications	 2 Same as standard		
	Additional balanced bipolar output (Option 22) (common option to receiving unit) Number of output Operating frequency Level	 2 1MHz to 6.5MHz 3V0-p		
	Load	120Ω (balanced)	100Ω to 110Ω (balanced)	
	Connector	Mates with M-214S		
Unipolar output (unbalanced)	Operating frequency Pattern Waveform Level Load Number of outputs Connector	1kHz to 50MHz NRZ ECL (High level: −1.1V Low level: −1.52V) 100Ω to ground and 300Ω to −5.2V 4 BNC female		
	Clock Level Load Number of outputs Connector	 ECL (High level: −1.1V Low level: −1.52V) 100Ω to ground and 300Ω to −5.2V 2 BNC female		
	Modified output (Option 31) (common option to receiving unit) Operating frequency Level Load Other specifications	 1kHz to 10MHz 0/+2.4V 75Ω nominal to ground Same as standard		
	Modified output (Option 32) (common option to receiving unit) Level Load Other specifications	 0/+3V 75Ω nominal to ground Same as standard		
1/63 pattern sync output	Level Load Connector	0.5Vp-p to 1.0Vp-p 50Ω nominal to ground BNC female		
Power		100V, 50/60Hz, ≦75VA		
Ambient temperature, rated range of use		0 to 50°C		
Dimensions and weight		Approximately 145H, 282W, 300D mm, ≦7.5kg		
Accessories supplied	Measuring cord	Five measuring cords (BNC •—• BNC): 2m Two measuring cords (M-214S •—• M-214S): 2m (Supplied when Option 22 is ordered)		

Continued on next page

Specifications (receiving unit)

Model		ME448A	ME448B	ME448C
Bipolar input	Timing recovery frequency	Any one frequency of the following (Specify the frequency when placing your order)		
		704kHz*1 2048kHz*1 8448kHz 34368kHz	1544kHz*1 3152kHz*1 6312kHz*1 32064kHz*2 44736kHz*2	
		*1 Specify Option 22 for balanced signal input *2 Don't specify 32064kHz and 44736kHz on the same unit		
	Code	AMI, HDB3 by switch selection	AMI, B3ZS, B6ZS by switch selection	AMI, B8ZS by switch selection
	Level	0.4 to 1.4V0-p, 0.8 to 2.8V0-p by switch selection (40 to 140mV0-p range is added when Option 40 is specified)		
	Impedance	75Ω nominal to ground		
	Connector	BNC female		
	One additional frequency as listed (Option 16)	704kHz*1 2048kHz*1 8448kHz 34368kHz *1 Specify Option 22 for balanced signal input	1544kHz*1 3152kHz*1 6312kHz*1 32064kHz*2 44736kHz*2 *1 Specify Option 22 for balanced signal input *2 Don't specify 32064kHz and 44736kHz on the same unit	
	Two additional frequencies as listed (Option 17)			
	Three additional frequencies as listed (Option 18)			
	Additional balanced bipolar input (common option to sending unit) (Option 22)	Input is changeable for balanced or unbalanced bipolar signal use.		
	Operating frequency	704kHz, 2048kHz	1544kHz, 3152kHz, 6312kHz	
	Code	Same as standard		
	Level	1.2 to 3.6V0-p (0.12 to 3.6V0-p range is added when Option 40 is specified)		
	Impedance	120Ω (balanced)	100Ω or 110Ω (balanced) by selection inside the unit	
	Connector	Mates with M-214S		
Unipolar input (unbalanced)	Operating frequency	1kHz to 50MHz		
	Pattern			
	Waveform	NRZ		
	Level	ECL (same as the sending unit output level)		
	Termination	100Ω to ground and 300Ω to −5.2V		
	Connector	BNC female		
	Clock			
	Level	ECL (same as the sending unit output level)		
	Termination	100Ω to ground and 300Ω to −5.2V		
	Connector	BND female		
	Modified input (Option 31) (common option to sending unit)			
	Operating frequency	1kHz to 10MHz		
	Pattern and clock input level	0/+2V to +3V		
	Impedance	75Ω nominal to ground		
	Other specifications	Same as standard		
	Modified input (Option 32) (common option to sending unit)			
	Pattern and clock input level	0/+3V		
	Impedance	75Ω nominal to ground		
	Other specifications	Same as standard		
Measuring pattern	Pseudo-random pattern	Maximum length $2^{15}-1$ or $2^{23}-1$ bits by switch selection		
Detecting error pulses	Binary errors	Bit-by-bit		
	Binary errors and code violation errors (Option 40)	By switch selection (See Note 5 on page 208)		
Error rate measurement	Display	1×10^{-9} to 9.9×10^{-3} (Two-digit LED and exponent)		
	Counting time	10^7, 10^8 or 10^9 bits by switch selection		
	Display hold time	0 or 1 sec by switch selection		

Continued on next page.

Model		ME448A	ME448B	ME448C
Error count measurement	Display	0 to 9.9×10^4 (Two-digit LED and exponent)		
Clock output	Level Load Connector	1 to 2V (positive) 75Ω nominal to ground BNC female		
Error pulses output	Level Load Waveform Connector	1 to 2V (positive) 75Ω nominal to ground RZ BNC female		
Recorder output		DC output of the exponent only of the measured result in error rate measurement: Variation in DC 0.5V steps from 10^{-9} to 10^{-3}		
Printer output		Measured result in error rate measurement two-digit LED and exponent (However, printing is made only when error pulses are counted) Measured result in error count measurement two-digit LED and exponent (Printing is made only when pushed start or stop button)		
Buzzer		Sounding is made when detected error pulses (ON, OFF by switch selection)		
Ambient temperature, rated range of use		0 to 50°C		
Power		100V, 50/60Hz, ≦45VA		
Dimensions and weight		145H, 282W, 300D mm, ≦6.5kg		
Accessories supplied	Measuring cord	Two measuring cords (BNC •—• BNC): 2m One measuring cord (M-214S •—• M-214S): 2m (supplied when Option 22 is ordered)		

Optional apparatus

- **Timer MS012A and Printer**
  Measured results are recorded together with the time, permitting continuous measurement over long periods of time.

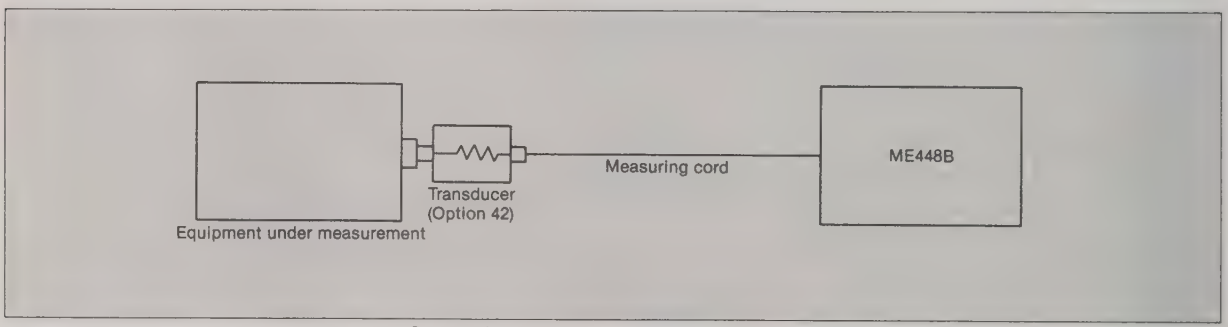
- **MZ102A DC-DC Converter**
  ME448A/B equipped with option 45 operates on station battery in conjunction with DC-DC Converter MZ102A.

Options

Item			Standard	Option number													Remarks
				11	12	16	17	18	21	22	31	32	40	41	42	44	45	
Sending unit	Clock (crystal oscillator)	Two frequencies	●															Specify frequencies within the range from 100kHz to 50MHz
		Three frequencies		●														
		Four frequencies			●													
	Bipolar output (unbalanced)	Two outputs	●															For testing 4PSK, 8PSK and 16 QAM radio PCM system or multiplexer
		Four outputs							●						●			
Receiving unit	Bipolar clock recovery	One frequency	●															Specify frequencies among those shown in specification table
		Two frequencies				●												
		Three frequencies					●											
		Four frequencies						●										
	Error rate measurement	Binary error	●															
		Code violation error											●					For digital line system
	GP-IB interface															●		For remote controlled operation
Common option to both sending and receiving unit	Bipolar input and output	Unbalanced	●															
		Bal. and unbal								●								1st order digital line system
	Unipolar input and output	ECL level	●															1kHz to 50MHz, 75Ω
		TTL level									●							1kHz to 10MHz, 75Ω
		0/+3V										●						1kHz to 50MHz, 75Ω
	DC power operation																●	Use in combination with MZ102A
Others	Bipolar signal measurement (unbal.) through high impedance												●		●			
	Connector replacement of cables supplied													●				Cables with 3CV-P on both ends are replaced by those with 3CV-P and SP-3CP on each end
Notes				1		2			3		4		5					

Note 1 to 4: Single option is possible among options in each group.
Note 5: Option 40 is the option for measuring the code violation errors.
The specification of input is as follows.
Unbalanced input: 40 to 140mV0-p, 0.4 to 1.4V0-p or 0.8 to 2.8V0-p by switch selection.
Balanced input: 0.12 to 0.36V0-p, 1.2 to 3.6V0-p by switch selection.
Other specifications are the same as standard.

High impedance measurement
(Specify Option 40 and Option 42 in placing order)
The connections of the measuring system are as follows.



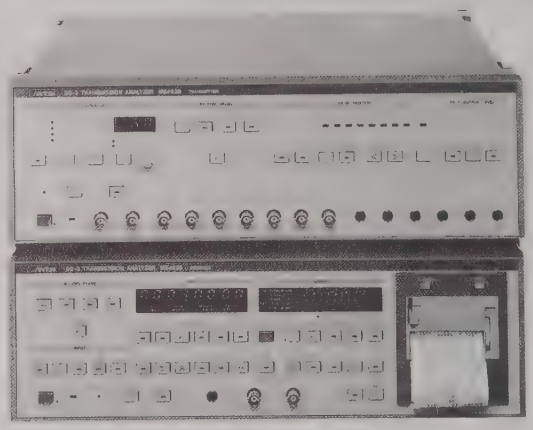
Connection diagram for unbalanced system

Ordering Information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
ME448A	Error Rate Measuring Equipment		for 30 CH system
ME448B	Error Rate Measuring Equipment		for 24 CH system (B3ZS, B6ZS)
ME448C	Error Rate Measuring Equipment		for 24 CH system (B8ZS)
	Standard accessories		
J0081	Coaxial cord, 2m:	7 pcs	BNC•—•BNC
	Fuse for ME448A/B, 2A:	2 pcs	MF51NN250V2AAC05
	Fuse for ME448A/B, 1A:	2 pcs	MF51NN250V1AAC05
	Fuse for ME448A/B, 3.15A:	2 pcs	MF51NN250V3.15ADC01
	Fuse for ME448A/B, 1.6A:	1 pc	MF51NN250V1.6ADC01
	Fuse for ME448A/B, 0.8A:	1 pc	MF51NN250V0.8ADC01
	Fuse for ME448A/B, 0.5A:	1 pc	MF51NN250V0.5ADC01
	Fuse for ME448A/B, 0.1A:	1 pc	MF51NN250V0.1ADC01
	ME448A/B/C Operation manual:	1 copy	
	Options		
ME448□-11	Additional one internal clock frequency for sending unit		Specify one frequency between 100kHz and 50MHz
ME448□-12	Additional two internal clock frequencies for sending unit		Specify two frequencies between 100kHz and 50MHz
ME448□-21	Additional two bipolar unbalanced outputs for sending unit		
ME448□-16	Additional one clock recovery frequency for receiving unit		
ME448□-17	Additional two clock recovery frequencies for receiving unit		
ME448□-18	Additional three clock recovery frequencies for receiving unit		
ME448□-40	Additional two functions: error pulse detection and code error measurement		
ME448□-44	GP-IB interface for receiving unit		
ME448□-22	Balanced type bipolar input/output		
ME448□-31	Modification of unipolar I/O level		To TTL level (Common to both sending and receiving unit)
ME448□-32	Modification of unipolar I/O level		To 0/+3V (Common to both sending and receiving unit)
ME448□-40/42	Additional high impedance measurement function for bipolar signal		
ME448□-41	Measuring cord modification		
ME448□-45	Modification for DC operation		MZ102A is also required
	Peripherals		
MS012A	Timer		With printer function
MZ102A	DC-DC Converter		Used in conjunction with option 45

DS-3 Transmission Analyzer ME462B 1MHz to 50MHz



To keep DS-3 transmission links operating at their best, you need to know every detail of their performance. That's why Anritsu created the DS-3 Transmission Analyzer ME462B. This instrument is specifically designed for testing and evaluating the performance of DS-3 transmission terminal and link equipment.

Together the sophisticated ME462B transmitter and receiver provide a host of measurements unavailable from any other source. The transmitter generates output levels that fully comply with Bell System DS-3 requirements, giving just what you need for complete end-to-end or loopback measurements. And with its built-in micro-processor, the receiver can simultaneously detect bit errors, parity errors, and bipolar violations. It can also measure any of these errors, as well as error seconds, error free seconds, total errors, and error rate. Moreover, the ME462B gives jitter modulation—perhaps the most important characteristic in a system.

An RS-232C or GP-IB option means you can use the ME462B for automatic measurement. And with the optional thermal printer installed in the receiver, you can generate many different types of data for long-term recording and analysis of the quality of a transmission line.

If you're involved in the commissioning, production test, maintenance and troubleshooting of digital radio and fiber optic systems, you need to take a closer look at the ME462B.

Features

- **Wide range of measurements :** Simultaneous measurement of error seconds, threshold error seconds, error free seconds, threshold error free seconds, total errors, and error rate.
- **Simultaneous error detection :** Detects bit errors, parity errors and bipolar variations—all at the same time.
- **Easy to operate :** The ME462B is so straightforward and easy to operate it actually slashes learning time.
- **Built-in printer available :** Optional built-in printer gives hard-copy measured results labelled with date and time or time interval. Gives error analysis as well as detection.
- **Wide jitter modulation :** Jitter modulation can be applied to the transmitter output signal, permitting accurate measurement of jitter immunity.
- **Many receiving input levels :** A wide range of receiving input levels (high, low, DSX-3 and DSX-3 low) means you can monitor virtually any point along the entire DS-3 route.
- **Versatile output signals :** Three levels of DS-3 output mean you can match levels at almost any point. And unipolar data outputs are available from six terminals, too, for 64 QAM testing.
- **Performs fading measurements :** Correlates field strength and error rate for fading measurements.
- **Error addition :** Internal and external error addition, in continuous or burst modes, allows thorough checking of a systems' error detection.

Specifications (transmitter)

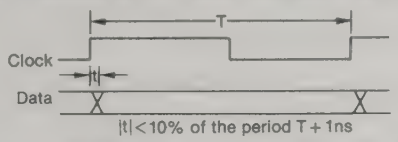
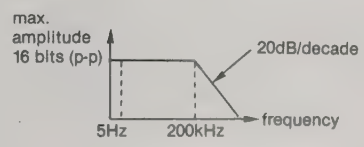
Clock	Internal	Frequency	44.736MHz
		Additional frequencies	One to four frequencies from 6MHz to 50MHz (OPT 01 to 04)
		Stability	Within ±10ppm
	External	Frequency range	1MHz to 50MHz
		Input level	0.7 to 1.5Vp-p
		Impedance	Nominal 75Ω unbalanced to ground
		Connector	BNC female
	Jitter	Bit rate	44.736Mbit/s (Modulation can only be applied when the clock is internal.)
		Frequency range	5Hz to 1MHz
		Amplitude	16.0 bits (p-p) max. Fig. 1 is typical
		Display	0.01 to 16.2 bits
		Accuracy	±5% ±0.1 bits
		Internal signal	Frequency: 2.3kHz ±10% Amplitude: continuously adjustable in the range 0 to 16 bits (p-p)
		Sensitivity	Nominal 4 bits (p-p)/1Vp-p (1kHz)
		Impedance	Nominal 75Ω unbalanced to ground
		Connector	BNC female
Pattern and frame	Measuring pattern	Pseudo-random	15 stages (32,767 bits per word). Conforms to CCITT Rec. 0.151
		Fixed	1111, 1100, 1010
	Frame		With or without DS-3 framing (by switch selection) When with framing, the standard Bell System DS-3 frame and control bits are added.
DS-3 output	Code		B3ZS
	High level	Amplitude	0.91V0-p ±1dB
		Width	11.2ns ±1.1ns (at half amplitude)
		Transition time	4.5ns ±1.5ns
		Overshoot/ undershoot	Less than 10% of pulse amplitude
	DSX-3 level		High level signal as specified above passed through equivalent of 450 feet of 728A cable
	Low level		High level signal as specified above passed through a 13.8dB attenuator (0.186V0-p ±1dB)
	Load		Nominal 75Ω unbalanced to ground
	Output number		6: 3 bits delayed for each of the six output phases, 1~6 in order
	Connector		Accepts a WECO 440A type plug
Unipolar output Data and clock	Format	Data	Binary NRZ (duty: within 90 to 110%)
		Clock	Square wave (duty: within 45 to 55%)
	Level		+1/−1V ±0.1V (0/+2.4V or ECL is possible by changing internal strapping.)
	Phase		 |t|<10% of the period T + 1ns
	Load		Nominal 75Ω unbalanced to ground
	Output number	Data	6: The output phases 1~4 each delay the PRBS 1/4 word in order, and output phases 4~6 each delay 500 bits or more. However, with a fixed pattern, all are delayed 2 bits each in order
		Clock	1
	Connector		BNC female

Fig. 1



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Error addition	Internal	Errors	Bit errors, bipolar violations. Bit errors will usually generate parity errors, since parity is calculated before the bit error addition. Bipolar violations are added so that a false B3ZS pattern is not generated. Bipolar violation is applicable for PRBS pattern only.
		Rate	Error rates from 10^{-2} to 10^{-9} and single error
	External	Errors	Bit errors. Single or burst errors by switch selection
		Pulse width	More than 100ns
		Interface	TTL
		Connector	BNC female
X bit input			It is possible to change X bit with an external signal
	Interface		TTL High: "1" Low "0"
	Connector		BNC female
Sync output	Clock	Level	TTL
		Load	Nominal 75Ω unbalanced to ground
		Connector	BNC female
	Pattern	Interface	TTL
		Connector	BNC female
	Multiframe	Interface	TTL
		Connector	BNC female
General	Power	AC	AC 115V* −15, +10%, 50/60 Hz, less than 100VA without options less than 110VA with options
		DC	−21.5 to −53V
	Dimensions		133H, 426W, 350Dmm
	Weight		Less than 12kg
	Ambient temperature, rated range of use		0 to 50°C

*A nominal AC line voltage between 100 and 250V is available on request.

Accessories supplied

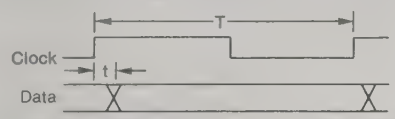
- One AC power cord
- 3 sets of fuses
- One instruction manual (For both transmitter and receiver section)

Additional options (Available at slight extra cost)

OPT 01: One additional frequency to internal clock from 6MHz to 50MHz
OPT 02: Two additional frequencies to internal clock from 6MHz to 50MHz
OPT 03: Three additional frequencies to internal clock from 6MHz to 50MHz
OPT 04: Four additional frequencies to internal clock from 6MHz to 50MHz
OPT 21: GP-IB (IEEE Std. 488-1978)
- Can control all items which are set by switches except the power and panel lock switches.
- Can output the jitter amplitude.

OPT 22: RS-232C
- Same as for GP-IB

Specifications (receiver)

DS-3 input	Frequency range		44.736MHz ±50ppm
	Code		B3ZS
	High level	Amplitude	0.6 to 1.8V0-p
		Width	11.2ns ±1.1ns (at half amplitude)
		Transition time	4.5ns ±1.5ns
		Overshoot/ undershoot	Less than 10% of pulse amplitude
	DSX-3 level		High level signal as specified above (level is 0.91V0-p ±1dB) passed through equivalent of 450 to 900 feet of 728A cable.
	Low level		High level signal as specified above (level is 0.91V0-p) with 12 to 30dB of attenuation.
	DSX-3 low level		DSX-3 level signal as specified above (cable length is 450 feet) with 15 to 30dB of attenuation.
	Impedance		Nominal 75Ω unbalanced to ground
	Connector		Accepts WECO 440A type plug
Unipolar input Data and clock	Frequency range		1MHz to 50MHz
	Format	Data	Binary NRZ (duty: within 90 to 110%)
		Clock	Square wave (duty: within 45 to 55%)
	Level		+1/−1V±0.1V (0/+2.4V or ECL is possible by changing internal strapping)
	Phase		 |t|<20% of the period T
	Impedance		Nominal 75Ω to unbalanced to ground
	Connector		BNC female
Pattern and frame	Measuring pattern	Pseudo-random	15 stages (32,767 bits per word). Conforming to CCITT Rec. 0.151
		Fixed	1111,1100, 1010
	Frame		With or without DS-3 framing by switch selection
Error	Error detection		Max. three error types are detected simultaneously. One type of these is displayed by switch selection. By using the IN SERVICE/OUT OF SERVICE and rear panel display switches, error detection can be limited to parity errors of bit errors.
		Bit error	By comparing the input signal with the internally generated reference pattern
		Parity error	By comparing the received parity bits in the control bits with the digital sum of the information bits in the previous frame
		Bipolar violation	Two consecutive bipolar violations of the same polarity
	Measuring items and range		Simultaneous measurement of four items, with one chosen for display via switch selection. Another switch allows measurement of error seconds or error free seconds to be set in synchronous or asynchronous modes.
		Error seconds	It is possible to measure each of error seconds with error rates in excess of 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7} and error rates less than 10^{-7} can be measured by using the built-in printer (optional). Range: 0 to 9.9×10^{9}
		Error free seconds (%)	It is possible to measure each of error free seconds with error rates in excess of 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7} and error rates less than 10^{-7} can be measured by using the built-in printer (optional). Range: 0 to 100(%)
		Total errors	Range: 0 to 9.9×10^{9}
		Error rate	Range: 9.9×10^{-2} to 1.0×10^{-15}
	Display	Error seconds and total errors	5-digit LED: When the numerical value exceeds 99999, it changes to exponential display (2 column mantissa, 1 column exponent).
		Error free seconds	5-digit LED: % display
		Error rate	5-digit LED:Exponential display (2 column mantissa and 2 column exponent with sign).
	Status indicators	LED	Signal loss, frame loss, pattern sync loss, blue signal, errors, gating, AC power fail
		Memory	Memory display and reset function in above condition (excluding errors and gating).
		Buzzer	Sounds are emitted when there is signal loss, frame loss, pattern sync loss, errors, blue signal An on/off control switch is available.

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Time	Measuring time	Time	Max. 99 days: 23 hours: 59 minutes: 59 seconds
		Clock	10^7 to 10^{12} bits
		Mode	Untimed (manual) or single or repeat mode by switch selection
		Display	The display of elapsed measuring time or remaining time is possible by switch selection. When being set on the clock, the measuring time is calculated from the frequencies.
		Current data	Switch allows display of current measuring data every 1 second.
	Real time clock	Display	Year: month: day: hour: minute: second Real time clock is backed up by Ni-Cd rechargeable battery.
Error output	Error		Bit errors, parity errors and bipolar violations are output separately.
	Format		Binary RZ
	Level		TTL is "low" when there is no error, and "high" when there is an error.
	Load		Nominal 75Ω unbalanced to ground
	Connector		BNC female
Sync output	Clock	Level	TTL
		Load	Nominal 75Ω unbalanced to ground
		Connector	BNC female
	Multiframe	Interface	TTL
		Connector	BNC female
	X bits	Interface	TTL
		Connector	BNC female
Alarm output			A relay is connected between two terminals. Its contact is breaked when not alarmed, maked when alarmed. Current capacity: DC 100V, 0.5A
Monitor input			Using the optional built-in printer, the value of external applied voltage and level of status input can be printed together with the error rate. The rate of time that this voltage exceeds an externally, adjustable reference voltage can also be printed.
	Voltage	Range	0 to ±20V
		Accuracy	± (2% +0.1V)
	Status	Interface	TTL
General	Power	AC	AC 115V* −15, +10%, 50/60Hz, less than 90VA without options less than 100VA with options
		DC	−21.5V to −53V
	Dimensions		133H, 426W, 350Dmm
	Weight		Less than 12kg
	Ambient temperature, rated range of use		0 to 50°C

*A nominal AC line voltage between 100 and 250V is available on request.

Accessories supplied

- One AC power cord
- 3 sets of fuses
- One instruction manual (Shares the same document with the transmitter section)

Additional options (Available at slight extra cost)

OPT 11: Built-in thermal printer. Print out of measured results and details of analysis.

OPT 31: GP-IB (IEEE Std.488-1978)
- Can control all items which are set by switches except the power and panel lock switches.
- Can output the measured results.

OPT 32: RS-232C
- Same as for GP-IB

Optional accessories

No.	Details	Check if desired	Required information
1	Connecting cable WECO 440A type•Special 3C-2W•WECO 440A type, 2m		Cable A and number of pieces
2	Connecting cable, BNC male•3C-2V•BNC male, 2m		Cable B and number of pieces
3	GP-IB connecting cable, 2m		Cable C and number of pieces
4	RS-232C connecting cable, 2m (to modem)		Cable D and number of pieces
5	Connecting cable, WECO 358 type•Special 3C-2W•WECO 440 type, 2m		Cable E and number of pieces
6	Thermal paper for printer (TP50KS-F)		TP50KS-F and number of packs (10 rolls/pack)
7	Portable test rack, tilt angle type		MB23A
8	Portable test rack, fixed horizontal type		MB24A
9	Soft carrying case[1]		Case A and number of pieces
10	Protective carrying case[1]		Case B and number of pieces
11	WECO ⟶ BNC Coaxial adaptor		WECO/BNC Coaxial adaptor and number of pieces

1 Each case holds either one transmitter or one receiver.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
ME462B	DS-3 Transmission Analyzer		
	Standard accessories		
J0171	Power cord, 2m	2 pcs	
	Fuse for ME462B, 5A	15 pcs	MF51NN250V5AAC05
	Fuse for ME462B, 2A	12 pcs	MF51NN250V2AAC05
	Fuse for ME462B, 1.6A	3 pcs	MF51NN250V1.6AAC05
	Fuse for ME462B, 1A	12 pcs	MF51NN250V1AAC05
	ME462B Operation manual	1 copy	
	Options		
ME462B-01	Additional one internal clock frequency for transmitter		Frequency range: 6 to 50MHz
ME462B-02	Additional two internal clock frequencies for transmitter		Frequency range: 6 to 50MHz
ME462B-03	Additional three internal clock frequencies for transmitter		Frequency range: 6 to 50MHz
ME462B-04	Additional four internal clock frequencies for transmitter		Frequency range: 6 to 50MHz
ME462B-11	Internal thermal printer		
ME462B-21	GP-IB interface		For transmitter
ME462B-22	RS-232C interface		For transmitter
ME462B-31	GP-IB interface		For receiver
ME462B-32	RS-232C interface		For receiver
	Optional accessories and aparatus		
J0070	Coaxial cord, 2m		WECO440A•Special 3C-2W•WECO440A
J0071	Coaxial cord, 2m		WECO358•Special 3C-2W•WECO440A
J0105A	Coaxial cord, 2m		BNC-P•3C-2V•BNC-P
J0008	GP-IB cable, 2m		
J0019A	RS-232C cable, 2m		
J0066	Coaxial adaptor		For WECO ⟷ BNC conversion
MZ133A	BON (Artificial line)		Equivalent of 450 feet WECO728A cable
B0059	Soft case A		
B0060	Soft case B		
MB23A	Portable Test Rack		Fixed table type
MB24A	Portable Test Rack		Variable tilt angle type
	Expendables		
Z0031B	Thermal roll paper for printer		TP50KS-4F, 10 rolls/set

Error Rate Measuring Equipment ME518A 1kHz to 150MHz

Receiving unit
Sending unit

《GP-IB》 OPTION

The Error Rate Measuring Equipment ME518A is a small, easy-to-operate measuring instrument used in digital systems over 1kbit/s to 150Mbit/s.
The ME518A is intended for use in maintenance, commissioning, and product testing of digital transmission terminal and link equipment. It is also useful for testing digital radio systems, digital line systems, digital multiplex and optical fiber equipment.
The ME 518A consists of two cabinets: the sending unit and the receiving unit. Consequently a single test set alone is capable of end-to-end measurements of digital systems and thus more economical. Of course, it is also capable of loop-back testing. The sending unit transmits an M-sequence (maximum length sequence) pseudo-random pattern which nature is similar to that of the pattern of actual PCM signals.
The receiving unit receives the signal from a system under measurement, detects error pulses, counts their number and displays them. The result of the error rate measurement is displayed by a digital display for direct readout of the error rate. Furthermore, in conjunction with Timer MS012A and printer, the ME518A permits recording of measured results with the time of measurements for continuous measurement for a long period of time.

Features

- Operating range: 1 kbit/s to 150 Mbit/s
- Loop-back and end-to-end measurements
- Suited for testing digital radio systems, digital line systems and optical fiber transmission systems.
  - Bipolar: Four outputs (AMI, HDB3)
  - Unipolar:
    - Pattern: Four outputs (NRZ)
    - Clock: Two outputs
  - CMI: Four outputs
  - 4B/3T: One output (option)
- Error rate measurement and error pulse counting by detecting binary errors or code violation errors
- Measuring pattern: Pseudo-random pattern maximum length $2^{15}-1$ or $2^{23}-1$ bits
- Monitoring of PCM line in service
- Recorder and printer outputs
- GP-IB interface (IEEE standard 488-1978, receiving unit only, option)

Specifications (sending unit)

Internal	Frequency	8.448MHz 34.368MHz 139.264MHz
	Stability	Within ±10ppm
External clock	Operating frequency	1kHz to 150MHz
	Input level	0.8 to 1.5Vp-p
	Impedance	75Ω nominal to ground
	Connector	BNC female
Output pattern	Pseudo-random pattern	15 or 23 stages by switch selection (maximum length $2^{15}-1$ or $2^{23}-1$ bits)
	Fixed pattern	1111 (all 1)
CMI output	Operating range	1Mbit/s to 150Mbit/s
	Code	CMI
	Level	1.0Vp-p
	Load	75Ω nominal to ground
	Number of output	4
	Connector	BNC female
Bipolar output	Operating range	1Mbit/s to 50Mbit/s
	Code	AMI, HDB3 by switch selection
	Level	1.0V0-p, 2.37V0-p by switch selection
	Load	75Ω nominal to ground
	Number of output	4
	Connector	BNC female
Unipolar output	Operating range	1kbit/s to 150Mbit/s
	Pattern	
	Waveform	NRZ
	Level	ECL
	Load	100Ω (ground) and 300Ω (−5.2V)
	Number of output	4
	Connector	BNC female
	Clock	
	Level	ECL
	Load	100Ω (ground) and 300Ω (−5.2V)
	Number of output	2
	Connector	BNC female
4B/3T output (Option 02)	Operating range	1Mbit/s to 120Mbit/s
	Code	FOMOT (MS43 is available on your request)
	Level	3V0-p to 6V0-p
	Load	75Ω nominal to ground
	Connector	BNC female
Pattern sync output	Level	1V
	Load	50Ω nominal to ground
	Connector	BNC female
Error addition		Approx. 1.5×10^{-5} errors addition to pattern is possible with a switch (only in PN15, 23)
Power		100V, 50/60Hz, ≦95VA
Ambient temperature, rated range of use		0 to 50°C
Dimensions and weight		Approx. 133H, 284W, 350Dmm, ≦10kg
Accessories supplied	Measuring cord	Five measuring cords (BNC – BNC, 75Ω): 2m

Specifications (receiving unit)

CMI input	Operating frequency	139.264Mbit/s
	Code	CMI
	Level	1Vp-p, 0.05Vp-p by switch selection
	Impedance	75Ω nominal to ground
	Connector	BNC female

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Unipolar input	Operating range	1kbit/s to 150Mbit/s
	Pattern	
	Waveform	NRZ
	Level	ECL
	Termination	100Ω (ground) and 300Ω (−5.2V)
	Connector	BNC female
	Clock	
	Level	ECL
	Termination	100Ω (ground) and 300Ω (−5.2V)
	Connector	BNC female
Bipolar input	Operating frequency	F1: 8.448Mbit/s. F2: 34.368Mbit/s
	Code	AMI, HDB3 by switch selection
	Level	F1: 2.37V0-p ±10%, 120mV0-p ±10% F2: 1.0V0-p ±10%, 50mV0-p ±10%
	Impedance	75Ω nominal to ground
	Connector	BNC female
4B/3T input (Option 02)	Operating frequency	104.448 Mbit/s
	Level	3V0-p to 6V0-p
	Impedance	75Ω nominal to ground
	Connector	BNC female
Measuring pattern	Pseudo-random pattern	15 or 23 stages by switch selection (maximum length $2^{15}-1$ or $2^{23}-1$ bits)
	Fixed Pattern	1111 (all 1), only in code violation errors
Detecting error pulses	Binary errors	Bit-by-bit
	Code violation errors	CMI: CMI code errors AMI: Bipolar rule error HDB3: Bipolar rule error and HDB3 code violation error
Error pulses rate measurement	Display	1×10^{-9} to 9.9×10^{-3} (Two-digit LED and exponent)
	Counting time	10^7, 10^8, or 10^9 bits by switch selection
	Display hold time	0 or 1 sec by switch selection
Error pulses count measurement	Display	0 to 9.9×10^4 (Two-digit LED and exponent)
Clock output	Level	−1V
	Load	75Ω nominal to ground
	Connector	BNC female
Error pulses output	Level	0V (no error), −1V (error)
	Load	75Ω nominal to ground
	Waveform	RZ
	Connector	BNC female
Recorder output		DC output of the exponent only of the measured result in error rate measurement: Variation in DC 0.5V steps from 10^{-9} to 10^{-3}
Printer output		The contents of display are printable out with a BCD-coded TTL level. Measured result in error rate measurement: two-digit LED and exponent (However, printing is made when error pulses are counted) Measured result in error count measurement: two-digit LED and exponent (Printing is made when pushed start or stop button)
Buzzer		Sounding is made when error pulses are detected (ON, OFF by switch selection)
Power		100V, 50/60Hz, ≦95VA
Ambient temperature, rated range of use		0 to 50°C
Dimensions and weight		133H, 284W, 350Dmm, ≦10kg
Accessories supplied	Measuring code	Two measuring cords (BNC – BNC, 75Ω): 2m One measuring cord (BNC – BNC, 50Ω): 2m

Options

Option 01 Additional one frequency to internal clock frequency range: 10 to 150 MHz

Option 02 Additional 4B/3T output (sending unit) and input (receiving unit)

Option 03 GP-IB (IEEE standard 488-1978, 24-pole connector) interface (receiving unit only)

Option 04 Unipolar output level (sending unit) and unipolar input level (receiving unit) (modified ECL level)

Option 05 Additional voltage-controlled crystal oscillator output (sending unit, 139.264 MHz ±20 ppm variable).

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
ME518A	Error Rate Measuring Equipment		1kHz to 150MHz
	Standard accessories		
J0105A	Coaxial cord, 2m:	7 pcs	BNC-P•3C-2V•BNC-P
J0133D	Coaxial cord, 2m:	1 pc	BNC-P•RG-58A/U•BNC-P
J0134	Power cord, 2.5m:	2 pcs	
	Fuse for ME518A, 3.15A:	2 pcs	MF51NN250V3.15AAC05
	Fuse for ME518A, 2A:	4 pcs	MF51NN250V2AAC05
	Fuse for ME518A, 1.6A:	2 pcs	MF51NN250V1.6AAC05
	Fuse for ME518A, 1A:	1 pc	MF51NN250V1AAC05
	Fuse for ME518A, 0.315A:	1 pc	MF51NN250V0.315AC05
	Fuse for ME518A, 0.1A:	1 pc	MF51NN250V0.1AAC05
	ME518A Operation manual:	1 copy	
	Options		
ME518A-01	Additional one internal clock frequency for transmitter		Frequency range: 10 to 150MHz
ME518A-02	Additional 4B/3T signal input/output		Supplied with ME518A 4B/3T operation manual
ME518A-03	GB-IB interface		Supplied with GP-IB operation manual
ME518A-04	Modification of unipolar output level		ECL level➡1/2 ECL level
ME518A-05	Additional VCO output		Frequency: 139.264MHz ± 20ppm

Digital Transmission Analyzer ME520B 1kHz to 150MHz (1kHz to 170MHz with Option 02)

《GP-IB》

The Digital Transmission Analyzer ME520B is an equipment used for measurement on error rate and jitter of PCM signals with clock frequencies ranging from 1kHz to 150MHz (in which 1st to 4th order PCM hierarchy and 10CH system are included).

It is possible to measure error rate and jitter simultaneously. Measured data are indicated on a digital display and analyzed at the same time. The analysis results in combination with time/date are printed out by an internal printer (optional), thus, long time continuous measurement is possible.

The ME520B is best suited for development and maintenance of radio PCM, wired PCM, optical fiber systems or other digital communication systems.

Its transmitter and receiver are housed in separate cabinets, therefore end-to-end measurement is possible. The transmitter generates M sequence pseudo-random pattern signals and jitter modulated signals those are close to actual transmitted signals. The receiver receives signals from a system under measurement and detects error and the amount of jitter.

Furthermore, the ME520B can perform error analysis in accordance with the CCITT Rec. G.821, so the ME520B is indispensable for evaluation of international communication circuit.

Features

- Conforms to CCITT Recommendations
- Simultaneous measurement of error and jitter
- Wide operating range: 1kHz to 150MHz
  1kHz to 170MHz (Option 02)
- End-to-end measurement
- A variety of test patterns enable testing digital systems including PCM transmission over cables, radio and optical fiber links
  CMI pattern : 4 outputs
  Bipolar pattern : 4 outputs
  AMI, HDB3 code
  Unipolar pattern : 4 outputs
  Clock : 2 outputs
- Measuring pattern
  Pseudo-random : $2^{10}-1$, $2^{15}-1$, $2^{23}-1$ bits
  Word pattern : Programmable 16 bits or 2×8 bits word
- Error addition
  Bit or code errors with 10^{-3}, 10^{-4}, 10^{-5} or 10^{-6} error rate or single error can be added to the sending pattern.
- Zero substitution
  The sequence can be disabled for 8 to 120 clock periods
- Code error measurement is possible for actual line in service.
- GP-IB
- Built-in printer (Option 01)

Transmitter specifications

Bit rate	Internal clock	Bit rate	704, 2048, 8448, 34368, 68736, 139264kbit/s
		Accuracy	±2ppm, ±5ppm/0 to 50°C
	External clock	Frequency	1kHz to 150MHz, (Option 02: up to 170MHz)
		Amplitude	0.3 to 3Vp-p, 1kHz to 1MHz (rectangular), >1MHz (Sine or rectangular)
		Impedance	Nominal 75Ω, unbalanced
		Duty cycle	50%
	Burst gate input	Amplitude	ECL level, high disables clock
		Impedance	Nominal 75Ω, unbalanced
		Termination	Nominal −2V
Clock output	Numbers		2 separate buffered outputs, common phase
	Polarity		CLOCK or $\overline{\text{CLOCK}}$, selectable
	Level	TTL	High state ≒2.5V, low state ≒0.5V
		ECL	ECL level
		SET	Amplitude 1 to 2V, offset 0 to ±2V
	Format		Square wave, 50 ±10% duty cycle on internal clock
	Impedance		75Ω, unbalanced
Pattern	PRBS (Pseudo-random binary sequence)		$2^{10}-1$, $2^{15}-1$, $2^{23}-1$
	Word		Freely programmable digital word, adjustable length 1 to 16 bits. Two 8-bit words, any possible setting. (Can be changed over by an external control signal)
	Zero substitution		Sequence can be disabled for 8 to 120 of clock periods, in multiples of 8 clock periods.
Error pulse	Error addition	Error rate	10^{-3}, 10^{-4}, 10^{-5} and 10^{-6}, selectable
		Single error	1 error is produced for each depression of key
	External error input	Impedance	Nominal 680Ω, unbalanced to −5.2V
		Frequency	DC to one-fourth of the clock frequency
Output data	CMI	Bit rate	1kbit/s to 150Mbit/s
		Amplitude	1 ±0.1Vp-p
		Numbers	4 separate buffered outputs, common phase
	Unipolar (RZ, NRZ)	Bit rate	1kbit/s to 150Mbit/s, (Option 02: up to 170MHz)
		Level	TTL, ECL, SET, selectable {TTL: high state≒2.5V, low state≒0.5V SET: amplitude 1 to 2V, offset 0 to ±2V}
		RZ duty cycle	50 ±10% on internal clock
		NRZ width	100 ±5%
		Numbers	4 separate buffered outputs, each delayed 4 bits
	Bipolar (RZ)	Bit rate	1kbit/s to 50Mbit/s
		Format	AMI, HDB3
		Amplitude	2.37 ±0.237V/0 ±0.237V or 1.0 ±0.1V/0 ±0.1V, selectable
		Numbers	4 separate buffered outputs, each delayed 4 bits
Jitter modulation	Function		Timing jitter can be added to the clock and data output signals by applying an external modulation source.
	Input	Frequency	DC to 5% or 2.5% of bit rate (see Fig. 1 and Table 1)
		Sensitivity	10UIp-p/V (5Hz)
		Impedance	Nominal 75Ω, unbalanced to ground
	Output	Display	10.10UIp-p, max.
	Jitter reference clock output	Level	ECL
		Impedance	Nominal low, unbalanced to ground

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Pattern sync output	Pattern	PRBS	1 pulse/1 sequence
		2 to 16 bits word length	1 pulse/2 sequences
		1 bit word length	1 pulse/4 bits
		2×8-bit word length	1 pulse/1 sequence
GP-IB interface			Meets IEEE Standard 488-1978
Ambient temperature, rated range of use			0 to 50°C
Power			AC 90 to 138V or AC 180 to 275V, 50/60Hz, approx. 200VA
Dimensions and weight			132.5H, 426W, 351Dmm, approx. 11kg
Accessories supplied			Two coaxial cords (BNC•3C-2V•BNC) 2m One power cord One set of fuses One operation manual (per transmitter-receiver combination)

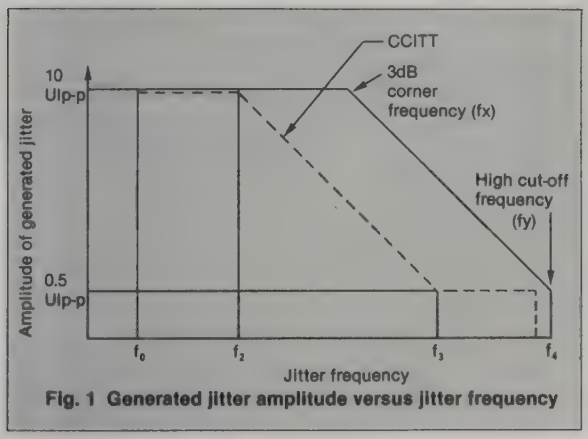

Fig. 1 Generated jitter amplitude versus jitter frequency

Table 1 Jitter frequency

	CCITT Rec. 0.171				ME520B	
Bit rate (kb/s)	f_0 (Hz)	f_2 (kHz)	f_3 (kHz)	f_4 (kHz)	fx* (kHz)	fy* (kHz)
704					4.5	35
2,048	2	2.4	45	100	13	102
8,448	2	10.7	200	400	50	422
34,368	2	1.0	20	800	210	1,000
68,736					300	2,000
139,264	2	0.5	10	3,500	600	4,000
EXT	Can be modulated at internal rates ±10%					

*Typical figures

Note:
When used in conjunction with the Jitter Modulation Oscillator MH370A, the ME520B can perform the maximum input jitter tolerance test according to the CCITT Rec. G. 703. For details, please refer to the MH370A data sheet.

Receiver specifications

Bit rate	Clock recovery	Receiving rate	704, 2048, 8448, 34368, 68736, 139264kbit/s
		Pulling range	±100ppm (AMI), ±3% (HDB3), ±1% (68736kbit/s CMI), ±3% (139264kbit/s CMI)
		Format	AMI, HDB3 (RZ, 704, 2048, 8448, 34368kbit/s) CMI (68736, 139264kbit/s)
	Clock Input	Polarity	CLOCK or $\overline{\text{CLOCK}}$, selectable
		Frequency	1kHz to 150MHz (Option 02: up to 170MHz)
		Amplitude	0.3 to 3Vp-p
		Impedance	75Ω, unbalanced
		Termination	Ground or nominal −2V (via switch)
Pattern	PRBS (Pseudo-random binary sequence)		$2^{10}-1, 2^{15}-1, 2^{23}-1$
	Word		Freely programmable digital word, adjustable length 1 to 16 bits
	Zero substitution		Sequence can be disabled for 8 to 120 of clock periods, in multiples of 8 clock periods
Input data	RZ, NRZ input	Bit rate	1kbit/s to 150Mbit/s, (Option 02: up to 170MHz)
		Threshold	−3V to +3V, ground or ECL, selectable
		Impedance	75Ω, unbalanced
		Amplitude	0.3 to 3Vp-p
		Polarity	DATA or $\overline{\text{DATA}}$, internally switched at the binary level

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(Continued)

Input data	CMI input	Threshold	Ground
		Impedance	75Ω, unbalanced
		Amplitude	1Vp-p automatic $\sqrt{f}$ equalization
		Monitor mode	Additional gain 26dB to 30dB
		Polarity	DATA or $\overline{\text{DATA}}$, internally switched at the binary level
	AMI, HDB3 input	Impedance	75Ω, unbalanced
		Amplitude	2.37V/0V (704, 2048, 8448kb/s), 1V/0V (34368kb/s), Automatic $\sqrt{f}$ equalization
		Monitor mode	Additional gain at 30dB: 704, 2048, 8448kbit/s Additional gain at 26dB: 34368kbit/s
		Polarity	DATA or $\overline{\text{DATA}}$, internally switched at the binary level
Error measurement	Bit error		Closed loop bit-by-bit detection at the binary level
	Code error	AMI	Bipolar violations are code errors
		HDB3	"Violation of violations" rule, i.e., two consecutive bipolar violations with same polarity.
		CMI	"Violation of CMI coding rules," i.e., two consecutive bits, whose intervals are one full unit time, with same polarity.
	Block error		For PRBS only, the block length coincides with the length of the PRBS. Error is detected if a block contains one or more bit errors.
	Pattern synchronization	Mode	Automatic or manual
		Sync gain	PRBS: No errors in 32 clock periods WORD: No errors in 32 to 512 clock periods
		Sync loss	PRBS: Approx. 10,000 errors in 30,000 clock periods WORD: Approx. 1,000 errors in 30,000 clock periods
Error display	Error rate	Display	0.00E-MN (0.00×10^{MN}), MN = 1 to 15 with automatic scaling
		Accuracy	Indication given if measurement result is based on <100 errors
	Error count	Method	Totalizes errors over selected gating period
		Display	6-digit LED display with leading zero blanking When count exceeds 999999, display automatically changes to 0.00E00, with automatic round-up to a maximum count of 9.99E15 (9.99×10^{15}).
	Error intervals	Method	Totalizes the number of intervals (1, 0.1, 0.01 sec.) which contain one or more errors (intervals can be selected by the switch on rear panel.)
		Display	Same as error count
	Error-free intervals %	Method	Totalizes the number of intervals (1, 0.1, 0.01 sec.) during which no errors occur over selected gating period.
		Display	6-digit LED display with leading zero blanking up to 100.000%.
Error performance display	%US (% unavailable second)		Displays % values including 4 digit of decimal part Error rate threshold: 1×10^{-2} to 1×10^{-4} Error count threshold: 1 to 999999, 1.00×10^{6} to 1.99×10^{7}
	%SES (% seveverely errord second)		Error rate averaged per 1 second or the total number of 1 second intervals exceeding threshold. Displays % values including 4 digit of decimal part. Error rate threshold: 1×10^{-2} to 1×10^{-4} Error count threshold: 1 to 999999, 1.00×10^{6} to 1.99×10^{7}
	%DM (% degraded minutes)		Error rate averaged per 1 second or rate of time in which 1 minute error count exceeding threshold. Displays % values including 4 digit of decimal part Error rate threshold: 1×10^{-5} to 1×10^{-7} Error count threshold: 1 to 999999, 1.00×10^{6} to 1.99×10^{8}
	%ES (% errored second)		The total number of 1 second intervals containing at least a one count error. Displays % values including 4 digit of decimal part
Status display	Display		Live and last record of No signal, sync loss, AIS, <100 errors

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Jitter measurement	Range, accuracy	1UI		0.000 to 1.010UIp-p
		10UI		0.00 to 10.10UIp-p, ±4% ±additional error a shown in Table 2 (with HP1, LP)
	Jitter amplitude versus jitter frequency			Refer to Fig. 2 and Table 3
	Hit count	Display		When count exceeds 999999, display automatically changes to 0.00E00, with automatic round-up to a maximum count of 9.99E15 (9.99×10^{15}).
		Sensitivity		Typically ≧100ns pulse width counted
		Hit threshold		Range 1:0.05 to 0.5UIp-p Range 10:0.5 to 5.0UIp-p
		Accuracy		Typically ±5%
	Hit intervals	Method		Totalizes the number of hit intervals (1, 0.1, 0.01 sec.) (intervals can be selected by the switch).
				Other specifications are sames as hit count.
	Hit-free intervals %	Method		Totalizes the number of intervals (1, 0.1, 0.01 sec.) during which no hits occur.
		Display		6-digit LED display with leading zero blanking up to 100.000%
Gating period and real-time clock	Gating period	Setting		Manual, clock, time
		Display	Last data	Displayed data and status record is data in last gating period.
			Current data	Displayed data and status record is data in current gating period.
	Real-time clock			Year, month, day, hour, minute, second
GP-IB interface				Meets IEEE Standard 488-1978
Ambient temperature, rated range of use				0 to 50°C
Power				AC90 to 138V or AC180 to 275V, 50/60Hz; approx. 230VA
Dimensions and weight				177H, 426W, 351Dmm; approx. 15kg
Accessories supplied				Two coaxial cords (BNC•3C-2V•BNC) 2m One power cord One set of fuses One operation manual

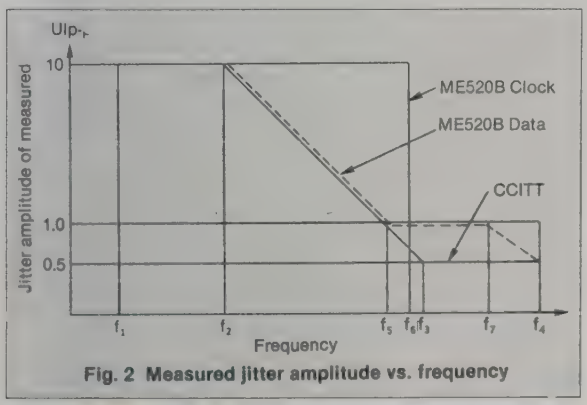


Fig. 2 Measured jitter amplitude vs. frequency

Table 2 Additional error

Range	Additional error in UIp-p				
	HDB3, CMI		Clock		
	F<139M	F≧139M	F≦70M	70M<F≦150M	F>150M (OPT 02)
Range 1	≦0.035	≦0.08*	≦0.01	≦0.02	≦0.03
Range 10	≦0.12	≦0.24	≦0.1	≦0.2	≦0.3

*As for the 139264kb/s CMI signals, their residual jitter can be improved by using the Clock Recovery MH547A.

Table 3 Jitter frequency

Bit rate (kb/s)	CCITT Rec. O.171				ME520B (typical)		
	f_1 (Hz)	f_2 (Hz)	f_3 (Hz)	f_4 (Hz)	f_5 (Hz)	f_6 (Hz)	f_7 (Hz)
704	(20)	(1k)		(35k)	7k	8k	10k
2,048	20	2.4k	4.5k	100k	24k	27k	30k
8,448	20	10.7k	200k	400k	107k	110k	120k
34,368	100	1k	20k	800k	10k	344k	320k
68,736	(100)	(40k)		(1M)	400k	400k	500k
139,264	200	500	10k	3.5M	100k	500k	1.4M

Options

01: Built-in printer: Supplied with six rolls of thermal paper

02: Operation up to 170MHz: With NRZ, RZ format

Note: Several kinds of internal clock frequencies (different from those of the standard model) are available as options. Refer to the ordering information.

Optional accessories

Item	Order No.	Remarks
Coaxial cord BNC•3C-2V•BNC, 2m	J0081	
GP-IB cable, 2m	J0008	
Roll paper for printer	Z0031	Two rolls/one set
Portable Test Rack MB23A	—	
Portable Test Rack MB24A	—	
Soft Carrying case for trasmitter section of ME520B	B0064	Protective covers for front and rear panel of transmitter (B0019) are required
Soft caarrying case for receiver section of ME520B	B0065	Protective covers for front and rear panel of receiver (B0020) are required
Protective case for transmitter section of ME520B	B0066	Soft carrying case (B0064) and protective covers (B0019) are required
Protective case for receiver section of ME520B	B0067	Soft carrying case (B0065) and protective covers (B0020) are required
Protective cover for transmitter section of ME520B	B0019	Two (front and rear) covers required
Protective cover for receiver section of ME520B	B0020	Two (front and rear) covers required
Rack mount kit 3U	B0042	
Rack mount kit 4U	B0043	
Matching Transformer MP35A	—	75Ω unbalanced/120Ω balanced (for 2048kb/s)
Clock Recovery MP547A (139264kb/s)	—	CMI, residual jitter: <0.025 UIp-p, HP1+LP, 25°±10°C

Ordering information

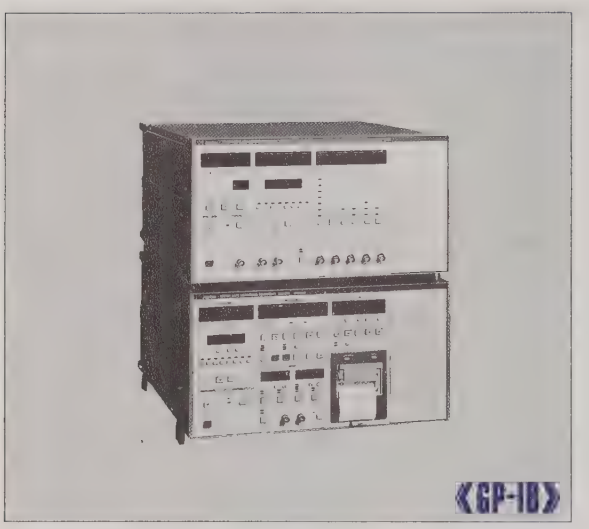
Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
ME520B	Digital Transmission Analyzer		
	Standard accessories		
J0081	Coaxial cord, 2m:	4 pcs	3CV-P2•3C-2V•3CV-P2
J0017	Power cord, 2.5m:	2 pcs	
	Fuse for ME520B Transmitter, 8A:	2 pcs	MF51NN250V8ADC05
	Fuse for ME520B Transmitter, 3.15A:	1 pc	MF51NN250V3.15ADC05
	Fuse for ME520B Transmitter, 0.8A:	1 pc	MF51NN250V0.8ADC05
	Fuse for ME520B Transmitter, 3.15A or 2A:	2 pcs	T3.15A250V/T2A250V
	(3.15A is for AC90 to 138V, 2A is for AC 180 to 275V)		
	Fuse for ME520B Receiver, 8A:	3 pcs	MF51NN250V8ADC05
	Fuse for ME520B Receiver, 1A:	2 pcs	MF51NN250V1ADC05
	Fuse for ME520B Receiver, 5A or 3.15A:	2 pcs	MF51NN250V5AAC05/3.15AAC05
	(5A is for AC90 to 138V, 3.15A is for AC180 to 275A)		
	ME520B Operation manual:	1 copy	

Continued on next page.

Model number/ Order number	Name	Remarks
	Options	
ME520B-01	Built-in thermal printer	Supplied with 6 roll paper
ME520B-02	Operation frequency range	Format: NRZ, RZ
ME520B-21	35.008MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-22	41.2415MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-23	104.448MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-24	141.040MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-25	141.248MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-26	141.475MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-27	167.1168MHz internal clock for transmitter	Format: NRZ, RZ. Option 02 is also necessary.
ME520B-29	32.064MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-30	110.592MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-32	143.360MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-33	30.720MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-35	25.776MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-36	8.192MHz internal clock for transmitter	Format: NRZ, RZ
ME520B-37	70.848MHz internal clock for transmitter	Format: NRZ, RZ
	Optional accessories	
MB23A	Portable Test Rack	Tilt angle type
MB24A	Portable Test Rack	Fixed table type
MP35A	Matching transformer, 75Ω unbal/120Ω bal	Fits to Siemens C42334-A284
MP547A	Clock Recovery Unit (1392 64kbit/s, CMI)	Residual jitter: <0.025UIp-p, HP1+LP, 25±10°C
J0081	Coaxial cord, 2m	3CV-P2•3C-2V•3CV-P2
G0008	GP-IB cable, 2m	
B0064	Soft case	For transmitter. B0019 also required
B0065	Soft case	For receiver. B0020 also required
B0066	Transport case	For transmitter. B0019 and B0064 required
B0067	Transport case	For receiver. B0020 and B0065 required
B0019	Protective cover (for transmitter)	2 pcs is necessary for front/rear panel
B0020	Protective cover (for receiver)	2 pcs is necessary for front/rear panel
B0042	Rock mount kit, 3U	
B0043	Rack mount kit, 4U	
	Expendables	
Z0031A	Printer paper	2 rolls/set

Error Rate Measuring Equipment
ME522A



In recent years, many systems have been digitalized, and the frequencies also have increased from year to year. Together with this, generation of various patterns for system evaluation and measuring functions for more detailed system evaluation and analysis are being demanded.
The ME522A is an error rate measuring equipment covering over 1MHz to 700MHz frequency range. The equipment is provided with an abundant pattern generation function, a wide input/output interface and a versatile error measuring function, so that it can be used with many systems.

Features

● Built-in synthesizer

The built-in clock oscillator uses the synthesizer method, so that the same stability as with a crystal oscillator can be obtained. The frequencies used frequently can be memorized.

- Frequency range: 1MHz to 700MHz in steps of 1kHz
- Frequency stability: ±2ppm
- Frequency memories: 9 frequencies

● Abundant measuring patterns

Various patterns convenient for measurement and analysis of systems can be generated, like four types of pseudo-random patterns from short to long periods, programmable patterns with long periods permitting generation of patterns just like system patterns, etc.

- Pseudo-random patterns: 2^7-1, $2^{10}-1$, $2^{15}-1$, $2^{23}-1$
- Programmable patterns: 3 patterns of max. 2048 bits each
- Mark ratio variable patterns: 1/8, 1/4, 1/2, 3/4, 7/8
- Alternate patterns: 8-bit programmable patterns
- Isolated patterns: 1/1 to 1/64

● Flexible input/output interface

Level, waveform, and impedance can be set according to the system.

- Level:
  Amplitude: 1 to 3V in steps of 0.05V, ECL
  Offset: −1 to +4V in steps of 0.05V, ECL
- Waveform: NRZ, RZ, $\overline{RZ}$, CMI
  AMI (unit use)
- Impedance: Switching between 50Ω and 75Ω system possible

● Powerful error measuring functions

Various error measuring and analysis functions useful for system evaluation and troubleshooting are provided.

- Measuring items:
  Error rate, unmber of error pulse, error interval (EI, the interval time is 0.01 sec, 0.1 sec, 1 sec), error free interval (EFI), frequency
- Error analysis
  Threshold EI, threshold EFI, error performance data (error free seconds, errored seconds, severely errored seconds, degraded minutes, unavailable seconds)

● Built-in printer

● Built-in clock with calendar

● GP-IB (Standard equipment), RS-232C (Option)

Measurement on 565Mb/s system

As shown below, various waveform type and frequency of signals are used in 565Mb/s systems. These include 139Mb/s CMI signals used on the MUX, D MUX, 565Mb/s bipolar signals used in between MUX, D MUX and fiber optic transmission terminal equipment and 678Mb/s unipolar signals used in fiber optic terminals.

- **Measurements using CMI signal**

The ME522A Transmitter has four routes of CMI signal output (3 output routes among them are located on its rear panel). Measurement on a system section between MUX and D MUX can be performed by applying four CMI signals in each route from ME522A transmitter to MUX, and receiving on CMI signal in a route from D MUX with ME522A receiver.

- **Measurements using bipolar signal**

Bipolar signal measurements can be conducted using several units in conjunction with the ME522A. The ME522A can supply 565Mb/s bipolar signal using the U/B Converter MH5104A after connecting its unipolar input terminal to the unipolar output terminal of the transmitter main frame of ME522A.

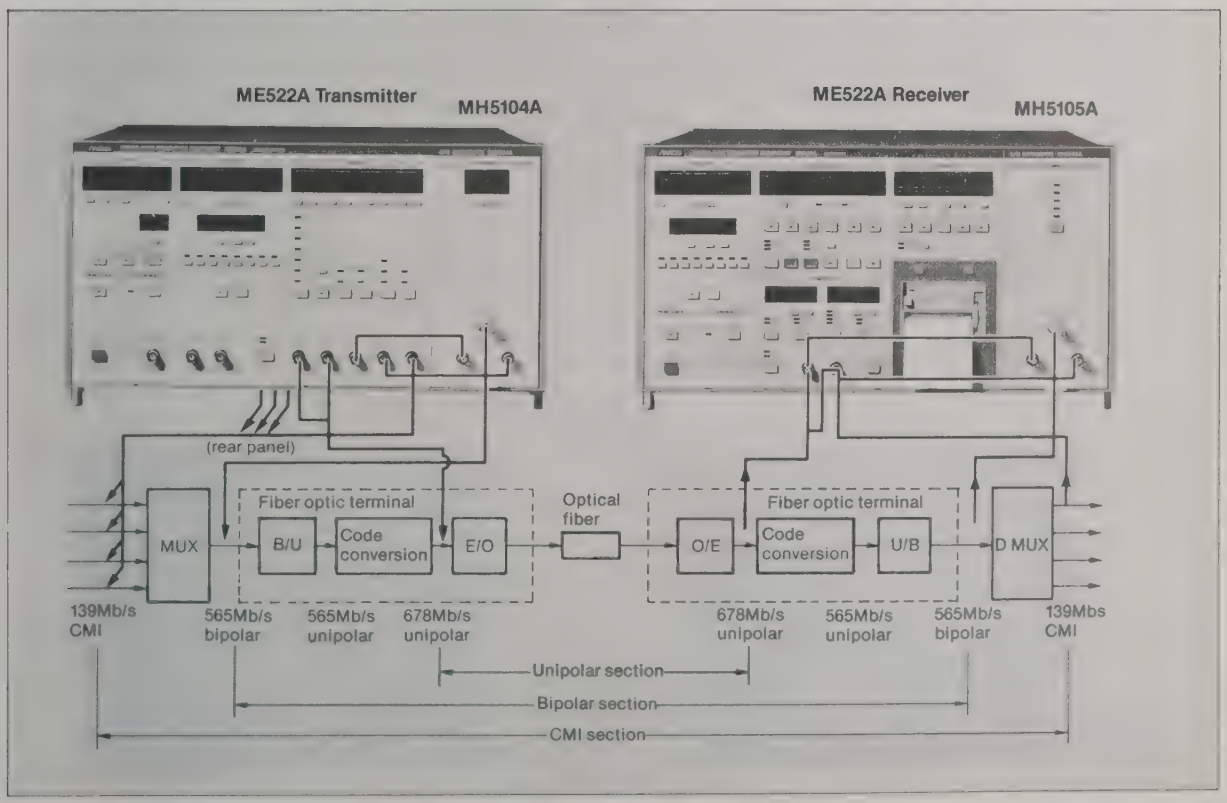
The ME522A can also receive 565Mb/s bipolar signals using the B/U Converter MH5105A after connecting its unipolar output terminal to the unipolar input terminal of the receiver main frame of ME522A. Bipolar signals are used for measurement on a system section between optic terminals.

- **Measurements using unipolar signals**

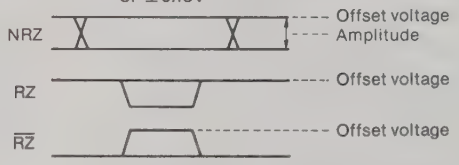
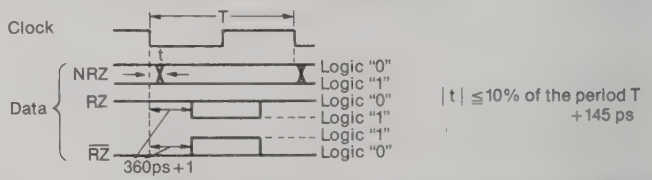
In a fiber optic terminal, received bipolar signals are primarily converted into unipolar signals, then applied code conversion and finally converted into optical signals. Reverse order conversions are also conducted.

- **Optical PCM signal measurement**

Combination of ME522A with MH945A and MH946A makes it possible to make measurement by optical interface. MH945A and MH946A are best suited for measurement of optical signal points of the optical fiber system, testing of optical repeater unit, optical fiber and optical device with LD.



Specifications (ME522A Transmitter)

Clock	Internal	Frequency range : 1.000MHz to 700.000MHz in steps of 1kHz Accuracy : Within $\pm 2 \times 10^{-6}$. After 30 minutes operation Frequency memory: 9 frequencies
	External	Frequency range : 1MHz to 700MHz Input level : 0.8 to 1.2Vp-p Input waveform: 1MHz to 10MHz: Rectangular waves 10MHz to 700MHz: Sinusoidal or rectangular waves Impedance : 75Ω Connector : BNC
Patterns	Pseudo-random patterns (PRBS)	7 stages, 10 stages, 15 stages,* 23 stages* (*According to CCITT Rec. O.151)
	Programmable patterns	3 patterns (A, B, C) with a word length of 8 to 2048 bits in steps of 8 bits. When the initial switch is set, patterns with mark ratio of 1/2, 1/4, and 1/8 are set for A, B, and C automatically.
	Alternate patterns	8-bit programmable patterns D and E
	Isolated patterns	1/1 to 1/64 (1/m: one mark ("1") in a pattern of m bits)
	Logic inversion	Logic inversion is possible for all of the above patterns.
	Gate	Gating by external signal is possible for all of the above patterns.
Unipolar output	Operation frequency	1MHz to 700MHz
	Clock 1, data 1	Waveform : Clock: RZ* (*Duty: Within 45 to 55% with internal clock) Data: NRZ, RZ*, $\overline{RZ}$* Amplitude : 1 to 3V in steps of 0.05V (However, display is made in steps of 0.1V) Also, ECL. (ECL: when connected to −2V via 50Ω or 75Ω) Offset: −1 to +4V in steps of 0.05V. (However, display is made in steps of 0.1V) Also ECL. (ECL: when connected to −2V via 50Ω or 75Ω) Level accuracy : Voltage and offset within the larger one of set value ±10% or ±0.15V 
	Clock 2, data 2	Waveform : Clock: RZ (Duty: Within 45 to 55% with internal clock) Data: NRZ Level : Within 0/−1V ±0.1V
	Phase, logic	Clock 1 : Switching is possible between CLOCK and $\overline{CLOCK}$ Between data 1 and data 2: PRBS pattern: About 1/2 period Other patterns: Same phase Between clock 1 and data 1 and between clock 2 and data 2:  (For $\overline{CLOCK}$, the time "t" is expressed using a rising edge as the reference)
	Load	Switching between 50Ω and 75Ω is possible (But clock 1, 2 and data 1, 2, 3 are coupled)
	Connector	BNC

Continued on next page.

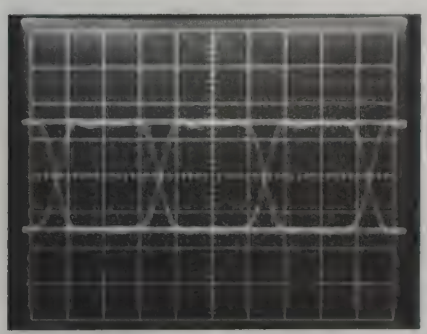
CMI output	Operation frequency	1MHz to 150MHz
	Number of outputs	4 (DATA 3 on the front panel, DATA 4 to 6 on the rear panel. Same phase.)
	Level	Within 1 ±0.1Vp-p
	Load	Data 3 : Switching between 50Ω and 75Ω is possible Data 4 to 6 : 75Ω
	Connector	BNC
Error insertion	Error	Bit error
	Internal	Ratio : 2×10^{-3}, 2×10^{-4}, 2×10^{-5}, 2×10^{-6}, 2×10^{-7}, single
	External input	Operation frequency : DC to 1/40 of the clock frequency Level : TTL Connector : BNC
Other input and output	Alternate signal input	Operation frequency : DC to 5MHz Level, connector : TTL (Low: Output of pattern D; High: Output of pattern E), BNC
	Gate signal input	Operation frequency : DC to 1/4 of the clock frequency Level, termination, connector: Within 0/−1V ±0.1V (0V: Signal through; −1V: Signal inhibit), 75Ω, BNC
	Clock sync output	Level, termination, connector: 0.3 to 1Vp-p (AC coupled), 50Ω, BNC
	Pattern sync output	Level, termination, connector: 0.3 to 1Vp-p (at 700MHz, AC coupled), 50Ω, BNC
Remote control	Interface control	GP-IB (Standard equipment, IEEE Std. 488-1978), RS-232C (Option)
	Control	Setting is possible for all switches except the power switch
Power		AC **V ±10%, 50/60Hz, max. 280VA (when the unit is not installed), max. 330VA (when the unit is installed)
Dimensions and weight		222H, 426W, 450D mm; max. 28kg (when the unit is not installed), max. 33kg (when the unit is installed)
Ambient temperature, rated range of use		0 to 50°C
Accessories supplied		One power cable Two BNC cables (50Ω), 2m One GP-IB cable, 2m One instruction manual

**Specify one nominal line voltage between 100V and 250V when ordering.

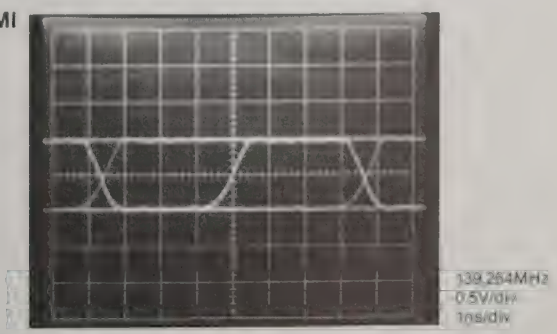
Option:

OPT 10 **RS-232C**

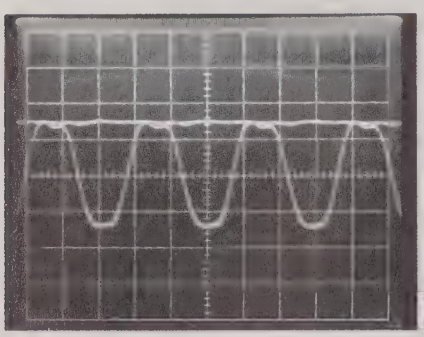
NRZ



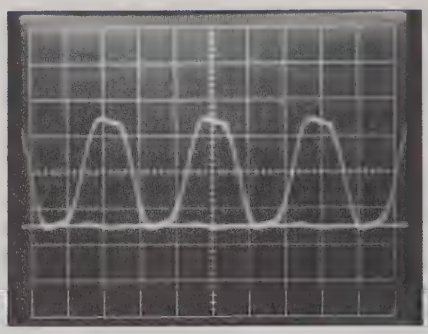
CMI



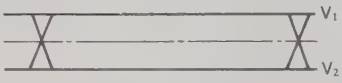
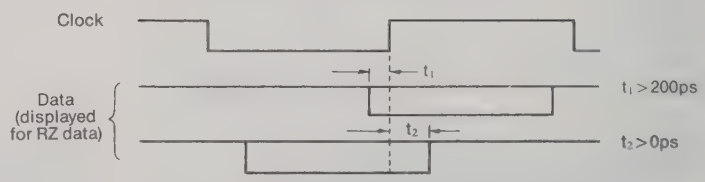
RZ



$\overline{RZ}$



Specifications (ME522A Receiver)

Unipolar input	Operation frequency	1MHz to 700MHz
	Clock, data	Waveform : Clock: RZ* (*Duty: Within 45 to 55%) Data: NRZ, RZ*, $\overline{RZ}$* Amplitude : 1 to 3V, ECL Offset : −1 to +4V, ECL Threshold voltage (data): −2.5 to +3.5V in steps of 0.05V. (However, display in steps of 0.1V)  Threshold voltage $=\frac{V_1+V_2}{2}$ Phase adjustment (clock): Switching between CLOCK and $\overline{CLOCK}$ and adjustment for ±500ps in steps of 100ps are possible. Phase relation between clock and data: After the phase adjustment described above; For NRZ data: freely selectable For RZ or $\overline{RZ}$ data: limited as follows  (For $\overline{CLOCK}$, the time "t" is expressed using a falling edge as the reference) Termination : Connection via 50Ω or 75Ω (Switch selection, clock and data are coupled) to earth (other than ECL) or −2V (ECL) Connector : BNC
CMI input	Operation frequency	Within 139.264MHz ±14kHz
	Level	Within 1 ±0.1Vp-p
	Termination	50Ω or 75Ω (Switch selection)
	Connector	BNC

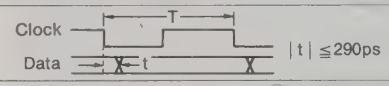
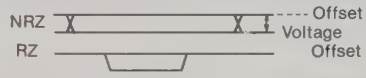
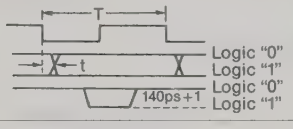
Continued on next page.

Patterns	Pseudo-random patterns (PRBS)	7 stages, 10 stages, 15 stages*, 23 stages* (*According to CCITT Rec. O.151)
	Programmable patterns	3 patterns (A, B, C) with a word length of 8 to 2048 bits in steps of 8 bits. With the initial switch setting, patterns with mark ratio of 1/2, 1/4, and 1/8 are set for A, B, and C.
	Isolated patterns	1/1 to 1/64 (1/m: One mark ("1") in a pattern of m bits)
	Logic inversion	Logic inversion is possible for all of the above patterns.
Measurement	Error detection and measurement	Bit errors (bit by bit comparison). All of the following measuring items are executed simultaneously. Display of the measuring values during measurement is possible (in intervals of 1 second).
	Measuring items and display range	Error rate : 0.0E−16 (0.0×10^{-16}) to 1.0E−0 (1) Number of errors : 0 to 99999 to 9.9E 16 (9.9×10^{16}) Error interval : Switching is possible between the intervals of 0.01 sec, 0.1 sec, and 1 sec. Switching is possible between synchronous mode and asynchronous mode 0 to 99999 to 9.9E 16 (9.9×10^{16}) Error free interval : 0.0000% to 100% Frequency : 1.000MHz to 700.000MHz. Error: Within ±(20ppm+1kHz) Voltage : 0.0 to 20.0V. Error: Within ±(2% +0.2V)
	Lamp indication	Power failure (lighting at the time of power supply recovery), signal loss*, pattern sync loss*, AIS*, error gating (the lamps marked by *also are available with memory).
	Buzzer	Buzzing at the time of signal loss, pattern sync loss, AIS, and error. Buzzing can be switched ON and OFF.
Measuring mode, real time clock	Measuring mode	Switching is possible between repeat, single, and untimed (manual).
	Measuring time	Time : 1 sec to 99 days, 23 hrs, 59 min, 59 sec in steps of 1 sec. Number of clock pulses: 10^7 to 10^{15} bits in steps of 1 digit Display : Display of the remaining measuring time and the elapsed time is possible. (Also possible when the measuring period is the number of clock pulses.)
	Real time clock	Year: Month: Day: Hour: Minute: Second Error : Within 4 sec. per day
Other input and output	Voltage input	0 to 20V or 0 to −20V
	Status input	Level, connector : TTL, BNC
	Alarm output	Normal : Open between 2 terminals. Abnormal (Power failure, signal loss, pattern sync loss, AIS): Short-circuit between 2 terminals. Terminal rating : DC 100V, 0.5A or less.
Printer	Printing method	Thermal
	Printing letter	Max. 20 characters/line
	Printing contents	Measured values (intermediate and final values), error occurrence, alarm status, threshold error interval, threshold error free interval, error performance data, time.
	Manual printing	Possible
Remote control	Interface	GP-IB (Standard equipment, IEEE Std. 488-1978), RS-232C (Option)
	Control	Setting is possible for all switches except the power switch. Transmission of measuring values is possible.
Power		AC **V ±10%, 50/60Hz, max. 200VA (when the unit is not installed) max. 250VA (when the unit is installed)
Dimensions and weight		222H, 426W, 450D mm; max. 22kg (when the unit is not installed); max. 27kg (when the unit is installed).
Ambient temperature, rated range of use		0 to 50°C
Accessories supplied		One power cable Four rolls of thermal paper for printer One instruction manual

**Specify one nominal line voltage between 100V and 250V when ordering.

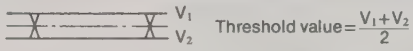
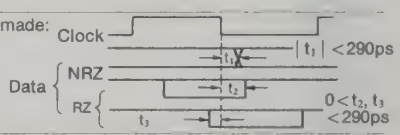
Option: **OPT 11** **RS-232C**

Specifications (MH676A Multiplexer)

Input	Operating frequency		350MHz to 700MHz
	Clock Data 1 Data 2	Waveform	Clock: RZ (Duty: 45 to 55% or less)
		Level	0/−1V ±0.1V or less
		Phase	
	Termination, connector		50Ω, BNC
Output	Operating frequency		Frequency which is two times as large as input clock
	Clock Data	Waveform	Clock: RZ*, Data: NRZ, RZ* (*Duty: 45 to 55% or less)
		Voltage	1 to +3V/0.05V step (however, indication is made in a step of 0.1V)
		Offset	−1 to +4V/0.05V step (however, indication is made in a 0.1V step) 
		Level error	Voltage and offset within the larger one of set value ±10% or ±0.15V
		Phase Logic	
	Load, connector		50Ω, N
Remote control	Interface		GP-IB (Standard provision, IEEE Std. 488-1978) RS-232C (Option)
	Details of control		Possible to set all switches
Dimensions and weight			215H, 95W, 446D mm, 5kg or less
Ambient temperature, rated range of use			0 to 50°C
Accessories supplied			BNC cable (50Ω) 0.4m : 3pcs. Semi-rigid cable (SMA, 50Ω) 0.5m: 2pcs. N-P•SMA-J converting adaptor : 2pcs. Operation manual : 1copy

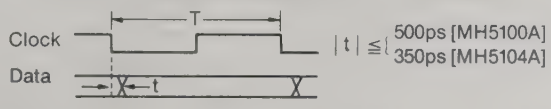
Option 12: RS-232C

Specifications (MH677A Demultiplexer)

Input	Operating frequency		700MHz to 1.4GHz
	Clock Data	Waveform	Clock: RZ*, Data: NRZ, RZ* (*Duty: 45 to 55% or less)
		Voltage	1 to 3V
		Offset	−1 to +4V
		Threshold value (Data)	−2.5 to +3.5V/0.05V step (however, indication is made in a 0.1V step) 
		Adjustment on phases (Clock)	±500ps/100ps step
		Phases between clock and data	When the abovementioned phase adjustment is made: 
	Termination, connector		50Ω, N
Output	Operating frequency		½ Frequency of input clock (350MHz to 700MHz)
	Clock Data 1 Data 2	Waveform	Clock: RZ (Duty: 45 to 55% or less), Data: NRZ
		Level	0/−1V ±0.1V or less
	Load, connector		50Ω, BNC
Remote control	Interface		GP-IB (Standard provision, IEEE Std. 488-1978) RS-232C (Option)
	Details of control		Possible to set all switches
Dimensions and weight			215H, 95W, 446D mm, 5kg or less
Ambient temperature, rated range of use			0 to 50°C
Accessories supplied			BNC cable (50Ω) 0.4m : 2pcs. Semi-rigid cable (SMA, 50Ω) 0.5m: 2pcs. N-P•SMA-J converting adaptor : 2pcs. Operation manual : 1copy

Option 13: RS-232C

Specifications (MH5100A/MH5104A U/B Converter Unit)

			MH5100A	MH5104A
Operation frequency			397.2MHz ±4MHz	564.992MHz ±6MHz
Input	Clock data	Waveform	Clock: RZ (Duty factor: Within 45 to 55%), Data: NRZ	
		Level	0/−1V ±0.1V	
		Phase		
		Termination	50Ω	
		Connector	BNC	
Output		Waveform	AMI (Duty factor: Nominal 50%)	AMI (Duty factor: Nominal 100%)
		Level	6Vp-p, +2 to −8dB in steps of 1dB	3.6Vp-p, +2 to −8dB in steps of 1dB
		Load	75Ω	
		Connector	SP	BNC
Remote control			Output level setting by ME522A transmitter is possible via GP-IB or RS-232C	
Dimensions and weight			215H, 95W, 446D mm, max. 3.5kg	
Ambient temperature, rated range of use			0 to 50°C	
Accessories supplied			Two BNC cables (50Ω), 0.4m One instruction manual	

Specifications (MH5101A/MH5105A B/U Converter Unit)

			MH5101A	MH5105A
Operation frequency			397.2MHz ±40kHz	564.992MHz ±60kHz
Input		Waveform	AMI (Duty factor: Nominal 50%)	AMI (Duty factor: Nominal 100%)
		Level	6Vp-p, +2 to −12dB switch selectable	3.6Vp-p, +2 to −12dB switch selectable
		Load	75Ω	
		Connector	SP	BNC
Input pattern			Pseudo-random patterns: 7, 10, 15, 23 stages Programmable patterns: do not include twelve or more zero succession	
Output	Clock data	Waveform	Clock: RZ (Duty factor: Within 45 to 55%), Data: NRZ	
		Level	0/−1V ±0.1V	
		Load	50Ω	
		Connector	BNC	
Remote control			Input level setting by ME522A receiver is possible via GP-IB or RS-232C	
Dimensions and weight			215H, 95W, 446D mm, max. 3.5kg	
Ambient temperature, rated range of use			0 to 50°C	
Accessories supplied			Two BNC cables (50Ω), 0.4m One instruction manual	

Specifications (MH945A E/O Converter Unit)

Electrical input	Operating frequency		1MHz to 700MHz
	Data	Level	0/−1V ±0.1V or less
		Waveform	NRZ, RZ
		Pattern	• PRBS patterns of 7, 10, 15 and 23 stages. • Programmable pattern with 63 or less zero succession. In case, however, at 10 MHz or below, 23 or less zero succession. • 1/N isolated pattern: N=1 to 64. In case at 10Hz or below, N=24 or less.
	Termination, connector		50Ω, BNC
Optical output	Wavelength		1.31 ±0.02μm
	Data	Power	−6 ±2dBm (at the times of RZ waveform in PRBS pattern with ½ mark ratio), averaged value
		Waveform	NRZ, RZ
		Extinction ratio	>13 dB
	Connector		FC-type (NOTE)
Remote control	Interface		Possible to control via GP-IB of the ME522A
	Control item		Optical output ON/OFF
Dimensions and weight			215H, 95W, 446D mm, 5kg or less
Ambient temperature, rated range of use			0 to 50°C
Accessories supplied			BNC cable (50Ω) 0.4m: 1pc. Operation manual : 1copy

Note: Please consult us for the change of optical connector.

Specifications (MH946A O/E Converter Unit)

Optical input	Wavelength		1.31μm band
	Data	Power	−15dBm to −3dBm (at the time of RZ waveform in PRBS with ½ mark ratio), averaged value
		Waveform	NRZ, RZ
		Pattern	• PRBS patterns of 7, 10, 15 and 23 stages. • Programmable pattern with 63 or less zero succession. In case, however, at 10MHz or below, 23 or less succession. • 1/N isolated pattern: N=1 to 64. In case at 10MHz or below, N=24 or less
	Connector		FC-type (NOTE)
Optical monitor input	Wavelength		1.31μm band
	Maximum input		0dBm (at the times of RZ waveform in PRBS pattern with ½ mark ratio), averaged value
	Connector		FC-type (NOTE)
Electrical output	Operation frequency		1 to 700MHz
	Data	Amplitude	0/−1V $^{+0.1}_{-0.5}$V
		Waveform	NRZ, RZ
	Termination, connector		50Ω, BNC
Electrical monitor output	Amplitude		>10mVp-p, at −10dBm optical input (at the time of RZ waveform in PRBS pattern with ½ mark ratio), averaged value
	Termination, connector		50Ω, OSM
Dimensions and weight			215H, 95W, 446D mm, 5kg or less
Ambient temperature, rated range of use			0 to 50°C
Accessories supplied			BNC cable (50Ω) 0.4m : 1pc Operation manual : 1copy

Note: Please consult us for the change of optical connector.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
ME522A	Error Rate Measuring Equipment		
	Standard accessories of main frame		
J0133C	Coaxial cord, 2m:	2 pcs	BNC-P•RG-58A/U•BNC-P
J0008	GP-IB cable, 2m:	1 pc	
J0017	Power cord, 2.5m:	1 pc	
Z0031B	Roll paper for printer:	4 rolls	TP50KS-F
	ME522A Operation manual	1 copy	

Continued on next page.

Model number/ Order number	Name		Remarks
	Plug-in units		
MH5100A	U/B Converter		397.2Mb/s
MH5101A	B/U Converter		397.2Mb/s
MH5104A	U/B Converter		564.992Mb/s
MH5105A	B/U Converter		564.992Mb/s
MH676A	Multiplexer		
MH677A	Demultiplexer		
MH945A	E/O Converter		
MH946A	O/E Converter		
	Standard accessories of plug-in units		
J0133F	Coaxial cord, 0.4m:	*pcs	BNC-P•RG-58A/U•BNC-P
	Semi-rigid cable, 0.5m	2 pcs	
J0004	Coaxial adaptor	2 pcs	N-P•SMA-J Supplied with MH676A/MH677A
	Operation manual	1 copy	
	Options		
ME522A-10	RS-232C interface		Supplied with ME522A Transmitter
ME522A-11	RS-232C interface		Supplied with ME522A Receiver
ME522A-12	RS-232C interface		Supplied with MH676A
ME522A-13	RS-232C interface		Supplied with MH677A
	Application equipment		
MN95D	Optical Variable Attenuator		
MN924A	Optical Attenuator		
MB24A	Portable Test Rack		
	Optional accessories		
J0019A	Modem connection cable, 2m		RS-232C
J0081A	Coaxial cord, 2m		BNC-P•3C-2V•BNC-P
J0107A	Coaxial cord, 2m		SP-3CP•3C-2T•SP-3CP
	Coaxial cord with SMA connector, 0.5m		
	Coaxial cord with SMA connector, 1m		
J0056B	Optical fiber cord, 2m		For SM fiber
J0200B	Optical fiber cord, 2m		For GI fiber
B0021	Front cover		
B0166	Carrying case		For ME522A Transmitter Supplied with protection cover
B0167	Carrying case		For ME522A Receiver Supplied with protection cover
B0168	Carrying case		For containing 2pcs of units
B0169	Soft case		For one main frame. Two protection covers are necessary

*Different number of J0133F cables are supplied with each unit.
MH676A: 3pcs. MH945A or MH946A: 1pc Other unit: 2pcs

Error Rate Measuring Equipment ME643A 50MH to 2GHz

Custom-made product

The Error Rate Measuring Equipment ME643A is a code error rate measuring system used for R&D and adjustment of high-speed PCM transmission systems and equipment in the operating clock frequency range from 50MHz to 2GHz.

The error rate is measured by bit-by-bit comparison between the signal from the system under measurement and the reference pattern at the receiving side, which is identical with the pattern generator at the sending side.

Although it would be ideal to use the actual signal transmitted in the system under measurement for measuring the error rate, it is not possible to make the reference pattern of the same sequence as the pattern generated at the transmitting end by using the actually transmitted signal. For this reason, in order to measure the error rate with the signal pattern closest to the actually transmitted signal pattern, a maximum length sequence pseudo-random pattern (herein-after to be abbreviated to a pseudo-random pattern) which can be separately generated on the receiving end and whose period of pattern is long with nearly random generation of "0" and "1", is used. This permits measuring the error rate which is close to the actual state of communication.

Moreover, a pattern of a 24-bit period which can be set freely (hereinafter called a programmable pattern) is used to analyze the cause of a special pattern of errors in PCM transmission.

Features

- Wide operating frequency range: 50 MHz to 2 GHz
- Low output jitter: ≦ 150ps
- Rise/fall time: ≦ 200ps
- Wide measuring range: 9.9999×10^{-1} to 1×10^{-12}
- Bit-by-bit error detection

Construction

The Error Rate Measuring Equipment ME643A comprises the Pulse Pattern Generator MG642A, the Error Detector MS65A, and the Timer MS02A with printer.

The signal pattern to be measured generated by the Pulse Pattern Generator MG642A is passed through the system under measurement and applied to the Error Detector MS65A. The detector has the reference pattern generator which generates the reference pattern for comparison with the pattern under measurement to detect error pulses. The two patterns are automatically synchronized by the automatic synchronizer.

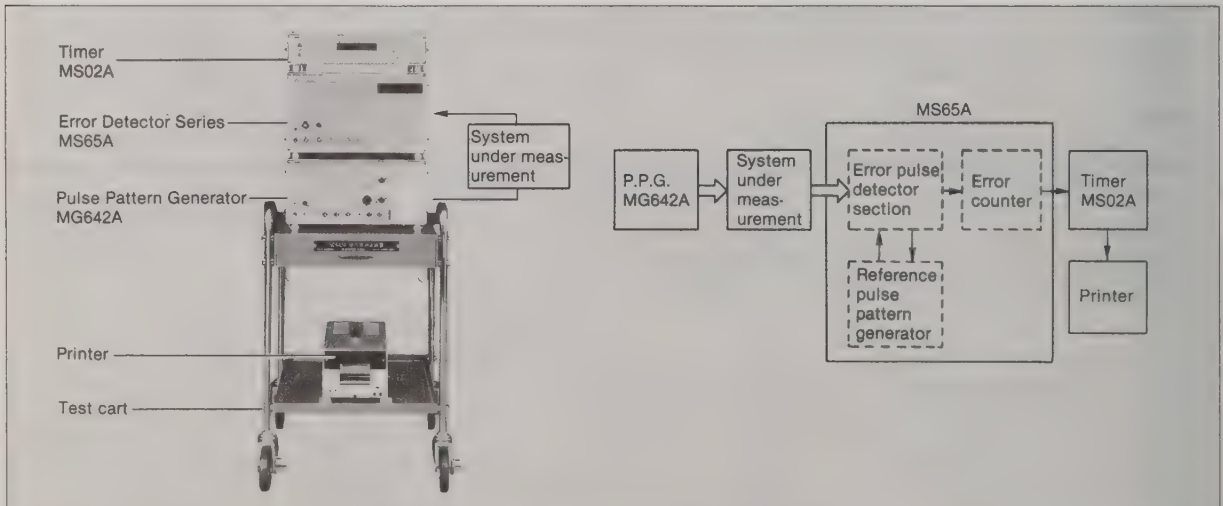
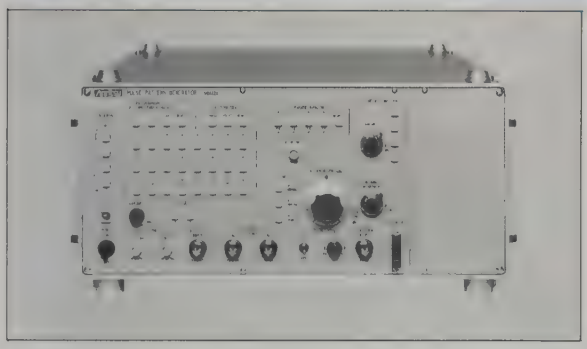


Fig. 1 Configuration of the Error Rate Measuring Equipment ME643A

The error pulses detected are counted by the counter, and the count is displayed on the display. When the Timer MS02A is used in conjunction with the printer for recording the count, the time (day, hour and minute) can be recorded along with the count.

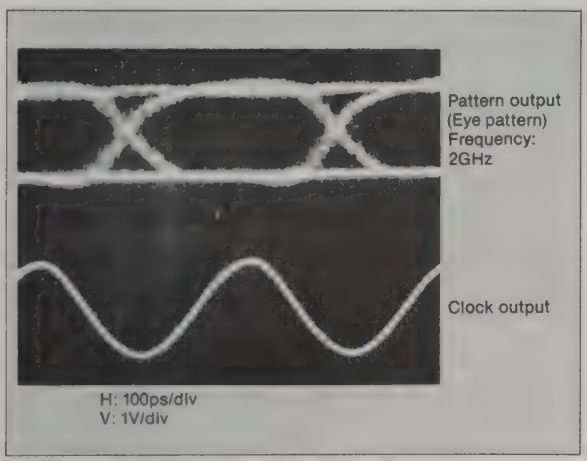
Pulse Pattern Generator MG642A



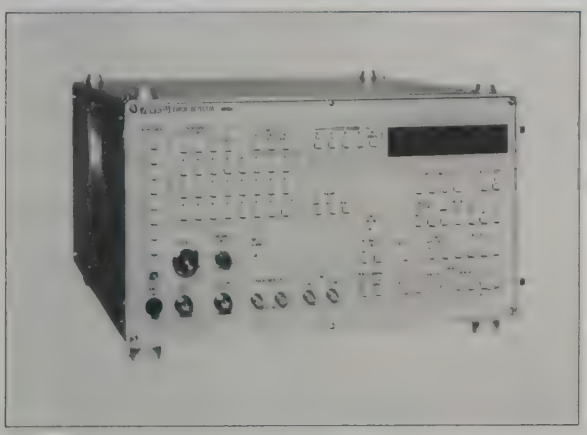
The MG642A is a pulse pattern generator operating at a clock frequency ranging from 50 MHz to 2 GHz.
A pseudo-random pulse train of 15 stages and programmable patterns of 8, 12, and 24 bits length are provided, and selection of those is simply carried out by a switch.

Features

- Wide operating frequency range: 50 MHz to 2 GHz
- High output level: 0/−2 V, 50 Ω (can be attenuated)
- Low jitter output: ≦150 ps
- Rise/fall time: ≦ 200 ps
- Offset available: 0 to ±2 V
- Output pattern delay available: 0 to 2.0 ns
- Built-in oscillator frequency range: 50 MHz to 2 GHz



Error Detector MS65A



The MS65A is a code error detector of operating frequencies ranging from 50 MHz to 2 GHz. Measurable pulse patterns are $2^{15}-1$ bit length pseudo-random patterns, and 8, 12 and 24 bit length programmable patterns. It is compatible with the Pulse Pattern Generator MG642A.
The MS65A compares the output pulse from the system under measurement, bit-by-bit, with a separately internally generated error-free pattern of same sequence as the sending pulse pattern generator.

Features

- Wide operating frequency range: 50 MHz to 2 GHz
- Wide measuring range: 9.9999×10^{-1} to 1×10^{-12}
- Synchronization protection for burst errors
- Bit-by-bit error detection
- Usable as a frequency counter:
  Direct counting: 10 MHz to 2 GHz

Specifications (Pulse Pattern Generator MG642A)

Operating frequency range		Internal clock	50MHz to 2GHz continuously variable
		External clock	50MHz to 2GHz
External clock input		Waveform	Sine wave of rectangular wave (duty factor: 50%)
		Level	0.7Vp-p to 2Vp-p, 50Ω
		Connector	Type N female
Generated patterns	Pseudo-random pattern	Pattern length	32767 bits ($2^{15}-1$)
		Mark density	1/8, 1/4, 1/2, $\overline{1/2}$, 3/4, 7/8, 8/8
	Programmable pattern	Pattern length	8, 12, 24 bits
Pattern output		Waveform	NRZ
		Output level	0/−2V, 50Ω
		Offset	±2V
		Polarity	NORMAL INVERSE
		Rise/fall time	≦200ps
		Jitter	≦150ps
		Output no.	1 system
		Connector	Type N female
Clock output		Waveform	Rectangular wave
		Output level	0/−2V (DC), 2Vp-p (AC), 50Ω
		Output no.	Two independent systems (DC), (AC)
		Connector	Type N female
Pattern sync output (for waveform observation trigger)		Waveform	Square wave
		Output level	≧0.5V, 50Ω
		Connector	BNC female
1/8 dividing clock output (for waveform observation trigger)		Waveform	Square wave
		Output level	≧0.5V, 50Ω
		Connector	BNC female
Output pattern delay			Pattern output can be delayed from the clock output: Variable range: 2.0ns (0.5ns × 4 steps and continuously variable) In addition, EXT DELAY may be connected.
External gate input		Waveform	Rectangular wave
		Input level	0/−1V, 50Ω
		Rise/fall time	≦1ns
		Pulse width	≦1μs
		Connector	BNC female
External control			Selection of type of transmitted pattern, setting of programmable pattern, marking density switching of pseudo-random pattern and output pattern polarity can be placed under external signal control.
Power supply			100V, 50/60Hz, ≦280VA
Ambient temperature, rated range of use			0 to 45°C
Dimensions and weight			195H, 426W, 450D mm, ≦28kg
Accessories supplied			One coaxial cord (S-5DWP•5D-2W•S-5DWP): 2m One coaxial cord (S-5DWP•5D-2W•S-5DWP): 1m Three coaxial cords (3CA-P2•RG-58A/U•3CA-P2): 2m

Specifications (Error Detector MS65A)

Operating frequency range			50MHz to 2GHz
Measurable pattern	Pseudo-random pattern	Pattern length	32767 bits ($2^{15}-1$)
		Mark rate	1/8, 1/4, 1/2, $\overline{1/2}$, 3/4, 7/8, 8/8
	Programmable pattern	Pattern length	8, 12, 24 bits
Pattern input		Waveform	NRZ, RZ (up to 1GHz)
		Level	0.7 to 2Vp-p 50Ω
		Threshold level	−1.3 to +1.0V
		Eye opening	Input signal eye opening must be ≧300ps
		Connector	Type N female
Clock input		Waveform	Sine or rectangular wave (duty factor: 50%)
		Level	0.7 to 2Vp-p 50Ω
		Connector	Type N female
Sync output for waveform observation	Clock sync	Waveform	Square wave
		Level	0/−0.5V 50Ω
		Connector	BNC female
	Pattern sync	Waveform	Square wave
		Level	0/−0.5V 50Ω
		Connector	BNC female
Phase adjustment of input clock pattern	Range		4.0ns (0.5ns × 8 steps and 0.5ns continuously variable)
	Monitor	Waveform	NRZ
		Level	0/−0.1V 50Ω
		Output no.	2 systems
		Connector	BNC female
Error pulse output		Waveform	NRZ or RZ
		Output no.	5 systems (of which one is the logical sum output for the rest)
		Output level	0/−1V 50Ω
		Connector	BNC female
Measuring items	Error rate	Measuring range	9.9999×10^{-1} to 1×10^{-12}
		Display	Digit no.: fixed point part: 5 or 2 digits, exponent: 2 digits
			Holding time: 0.5, 2, 5, 10s
			Storage: ON-OFF
	Error cumulative count	Measuring range	0 to 99999 count
		Measuring time	Start/stop manually set
	Frequency	Measuring range	10MHz to 2GHz
		Measuring accuracy	1×10^{-6}/day ±4 in count
Automatic synchronization		Sync. start error rate	Errors $<1\times10^{3}$ in 4×10^{4} bits of clock
		Out of sync. error rate	Errors $\geqq1\times10^{5}$ in 4×10^{6} bits of clock
Data printing	Printing instruction		Every cycle*1, Error period*2
	Output level		TTL level negative logic
Other displays	Overflow		Red lamp lighted
	Display of "under measurement"		
	Out of sync alarm		
	Input interruption alarm		
External control			Selection of the type of pattern to be measured, setting of a programmable pattern, selection of marking rate of pseudo-random pattern, and positive/negative of pattern logic can be put under external signal control
Power			100V, 50/60Hz, ≦370VA
Ambient temperature, rated range of use			0 to 45°C
Dimensions and weight			245H, 426W, 450Dmm, ≦33kg
Accessories supplied			Two coaxial cords (S-5 DWP•5D-2W•S-5 DWP): 2m Three coaxial cords (3CA-P2•RG-58A/U•3CA-P2): 2m

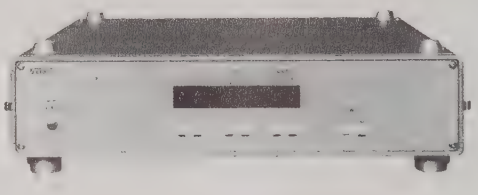
Custom-made product

*1 Every cycle: when closing gate of error counter and measure end, the print command pulse is sent to printer every measuring cycle.
*2 Error period: while no error in any measuring cycle, print command pulse is not sent. However, if the MS65A detects at least an error it sends the print command at the end of measuring cycle.

Timer MS02A

The timer is used for recording the measured results of the Error Detector MS65A simultaneously with the date (day, hour, and minutes). The longest time of the timer is 99 days 23 hours and 59 minutes.

Power	100V, 50/60Hz, ≦40VA
Ambient temperature, rated range of use	0 to 45°C
Dimensions	95H, 426W, 450Dmm
Weight	≦8kg



MS02A

Format of printing

A. Error rate display

(a) Printing format when the error rate is 9.9999×10^{-1} to 1×10^{-9}:

Example: 1.2513×10^{-5}

$$\underbrace{0\,0}_{\text{Day}}\ \underbrace{0\,0}_{\text{Hour}}\ \underbrace{0\,0}_{\text{Min}} * 1\,2\,5\,1\,3 - 5$$

(b) Printing format when the error rate is 9×10^{-10} to 1×10^{-10}:

Example: 1×10^{-10} $\underbrace{0\,0}_{\text{Day}}\ \underbrace{0\,0}_{\text{Hour}}\ \underbrace{0\,0}_{\text{Min}} * 0\,0\,0\,0\,1\,1\,0$

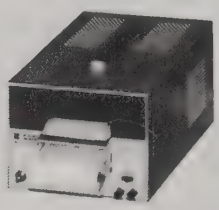
(c) An overflow is printed in red.

B. Count

(a) Printing format

$$\underbrace{0\,0}_{\text{Day}}\ \underbrace{0\,0}_{\text{Hour}}\ \underbrace{0\,0}_{\text{Min}} * \underbrace{0\,0\,0\,0\,0}_{\text{Count}} - -$$

Printer



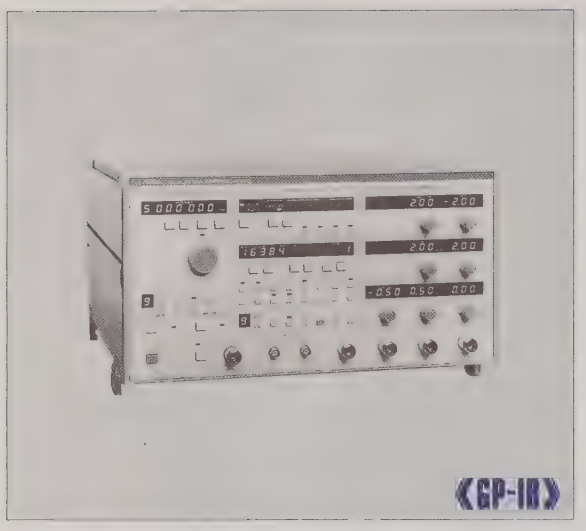
Places	14 digits
Maximum printing speed	2 line/s
Recording paper	Folded sheet, 90mm in width
Power	85 to 100V, 50/60Hz, approx. 50VA
Ambient temperature, rated range of use	0 to 45°C
Dimensions and weight	148H, 200W, 355Dmm, ≦10kg

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
ME643A	Error Rate Measuring Equipment		50MHz to 2GHz
	Component units		
MG642A	Pulse Pattern Generator		
MS65A	Error Detector		
MS02A	Timer		
	Standard accessories of MG642A		
J0025C	Coaxial cord, 2m:	1 pc	S-5DWP•5D-2W•S-5DWP
J0025A	Coaxial cord, 1m:	3 pcs	S-5DWP•5D-2W•S-5DWP
J0133C	Coaxial cord, 2m:	3 pcs	3CA-P2•RG-58A/U•3CA-P2
	Fuse for MG642A, 5A:	2 pcs	MF51NN250V5AAC05
	Fuse for MG642A, 5A:	2 pcs	MF61NN250V5AAC05
	Fuse for MG642A, 2A:	2 pcs	MF61NN250V2AAC05
	Fuse for MG642A, 0.1A:	2 pcs	MF61NN250V0.1AAC05
	MG642A Operation manual:	1 copy	
	Standard accessories of MS65A		
J0025C	Coaxial cord, 2m:	2 pcs	S-5DWP•5D-2W•S-5DWP
J0133C	Coaxial cord, 2m:	3 pcs	3CA-P2•RG-58A/U•3CA-P2
	Fuse for MS65A, 5A:	2 pcs	MF51NN250V5AAC05
	Fuse for MS65A, 5A:	4 pcs	MF61NN250V5AAC05
	Fuse for MS65A, 3.15A:	2 pcs	MF61NN250V3.15AAC05
	Fuse for MS65A, 2A:	2 pcs	MF61NN250V2AAC05
	MS65A Operation manual:	1 copy	
	Standard accessories of MS02A		
J0068B	50 pole cable, 0.5m:	1 pc	
J0216	Power cord	1 pc	
	Fuse for MS02A, 1A:	1 pc	MF61NN250V1AAC05
	Fuse for MS02A, 2A:	1 pc	MF61NN250V2AAC05
	Fuse for MS02A, 2A:	2 pcs	MF51NN250V2AAC05
	MS02A Operation manual:	1 copy	
	Other component units		
VP491C	Printer	1 pc	
MB4B	Test cart for ME643A	1 pc	
MH098A	GP-IB control system for MG642A/MS65A		

Pulse Pattern Generator
MP1601A



Today's computers and communications are getting faster and more sophisticated than ever before—and demand truly sophisticated test and measuring equipment. The Anritsu MP1601A Pulse Pattern Generator is just such an instrument. With a frequency range of 50MHz to 5GHz, and a highly versatile control panel, the MP1601A is perfect for testing a variety of computer and communications components and systems.

The MP1601A is a pulse generator with speed to spare. It's ready for today's high-capacity, high-speed digital fiber optics circuits, including laser diodes, optical elements and digital ICs. It can even handle GaAs logic ICs and Josephson elements.

Using all the knowledge gained from our popular 2GHz model, the new MP1601A Pulse Pattern Generator offers higher speed and substantially improved operation. It's smarter, too. Most controls—including those for output amplitude, offset, delay, and more—can be controlled using GP-IB. You'll find the MP1601A is not only the fastest, but also the "smartest" pulse generator around.

Applications

- Development of large-capacity optical digital transmission systems
- Development of high-speed optical devices
- Development of high-speed digital ICs

Features

● Crystal-controlled VFO clock generator

The internal clock generator uses a variable frequency oscillator synchronized with a crystal oscillator; this results in a clock signal of remarkable frequency stability. You can switch-select either of two clock resolutions, too.

And for frequencies you use over and over, an internal memory holds them ready for fast, easy measurement.

- Frequency range: 50MHz to 5GHz
- Stability: ±10ppm
- Frequency resolution: Switch between 1kHz or 1MHz
- Memory: 10 frequencies

● Variety of patterns

Some eight kinds of pseudo-random patterns can be generated, in the range from 2^7-1 to $2^{23}-1$; so you can select a pattern best suited to a particular test specification.

The MP1601A can generate pulse patterns that are long—up to a maximum of 16384 bits—making the instrument extremely useful for testing and analysis of LAN and other logic circuits.

- Pseudo-random pattern: 2^N-1; N=7, 9, 10, 11, 15*, 20, 23
- Programmable pattern: 16384 bits maximum.
- Mark rate variable pattern: 1/8, 1/4, 1/2, 3/4, 7/8. (For 1024-bit PRBS pattern only)
- Pattern memory: 10 patterns.

● "Smart" output interface

Pattern and clock output levels and offset voltage can be controlled in steps of 0.05V; and delay between pattern and clock can be set to the nearest 10ps, making this instrument an excellent choice for high-precision applications such as testing GaAs logic ICs. For completely automatic testing, you can control all of these outputs via GP-IB.

- Output amplitude: 0.5 to 2Vp-p, in 0.05V steps
- Offset: 0 to ±2Vp-p, in 0.05V steps.
- Waveform: NRZ
- Clock output: Pattern output delay variable ±500ps in 10ps steps

● Auxiliary outputs for testing multiplexer circuits

Four system outputs with mark speed of 1/4 of the clock frequency are available for testing MUX circuitry, etc.

- 1/4 clock output: One signal at 1Vp-p
- 1/4 pattern output: Four signals at 1Vp-p

● Standard GP-IB

GP-IB interface is standard equipment on the MP1601A, so you're immediately ready for completely automatic testing or monitoring.

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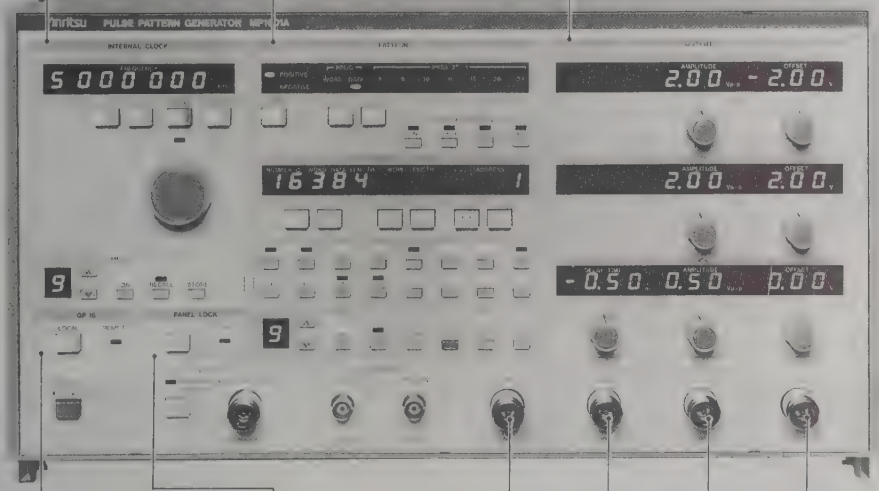
* The MP1601A can generate two types of $10^{15}-1$ PRBS pattern. The one is that which conforms to CCITT Rec. O.151, the other is that is interchangeable with Anritsu 2G bit/s pulse pattern generator.

INTERNAL CLOCK
Sets clock frequency in 1kHz or 1MHz steps. Memory for 10 different often-used frequencies

PATTERN
Selects output pattern. Specifies programmable pattern.

OUTPUT
Sets pattern and clock output parameters.



GP-IB
All controls except on/off and external clock range can be programmed using GP-IB.

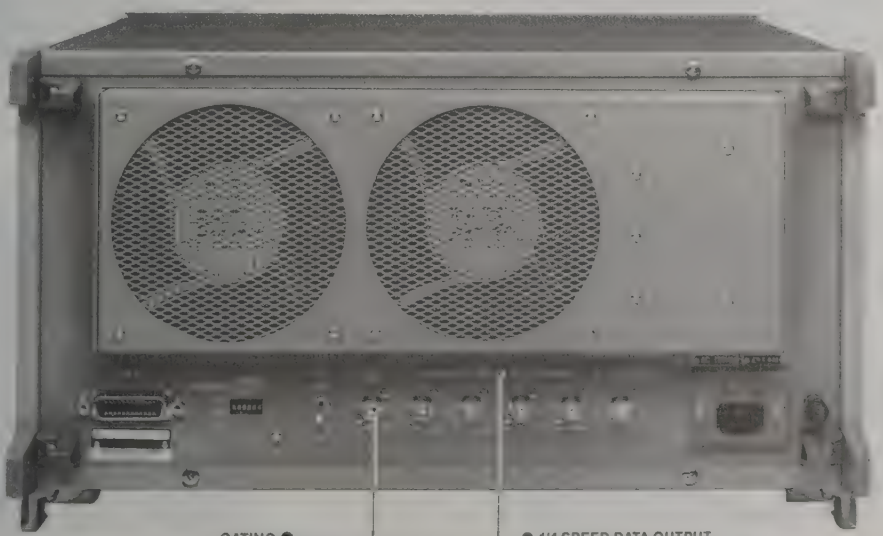
PANEL LOCK
Locks all controls at current status; prevents resetting errors.

DATA
For frequencies above 1.5GHz

$\overline{\text{DATA}}$
For frequencies of 1.5GHz and below.

CLOCK 1
Level, delay, offset voltage can be varied.

CLOCK 2
Level, delay, offset voltage are fixed.

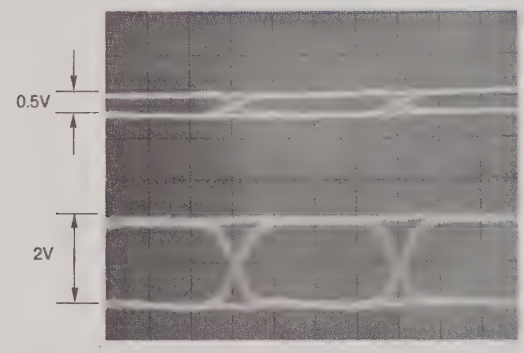


GATING
Used when 0 level is in pattern output.

1/4 SPEED DATA OUTPUT
Output four system patterns and a system clock with 1/4 speed of basic clock output.

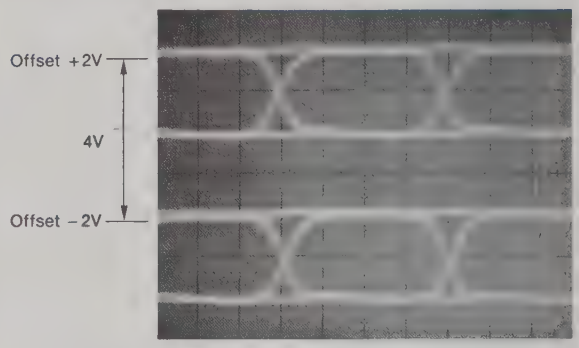
Measurement examples

Pattern output level



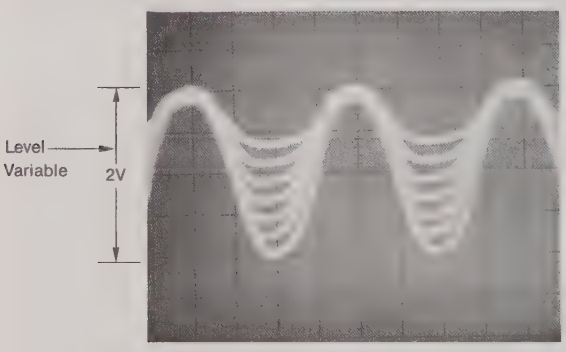
V: 1V/div
H: 50ps/div

Pattern output offset



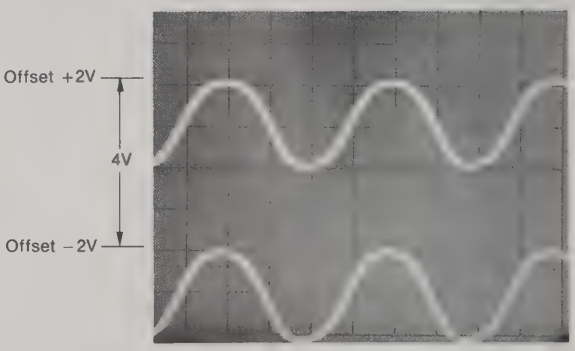
V: 1V/div
H: 50ps/div

Clock output level



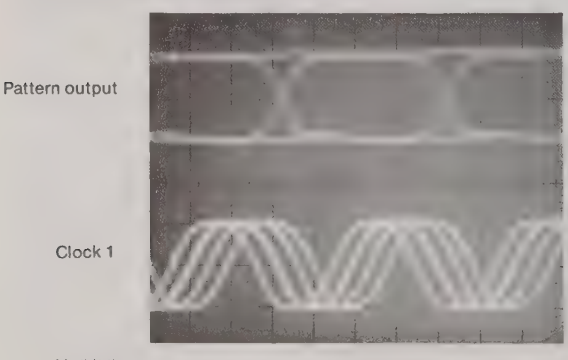
V: 0.5V/div
H: 50ps/div

Clock output offset



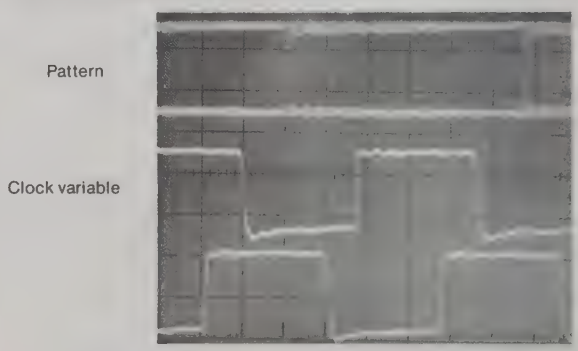
V: 1V/div
H: 50ps/div

Delay between clock and pattern (1)



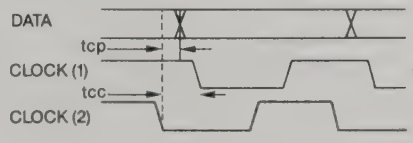
V: 1V/div
H: 50ps/div

Delay between clock and pattern (2)



V: 1V/div
H: 500ps/div

Specifications

Clock	Internal	Frequency range : 50MHz to 5GHz Frequency setting resolution : 1kHz, 1MHz Frequency accuracy : $\pm 1 \times 10^{-5}$ or better Frequency memory : 10 frequencies
	External	Frequency range : 50MHz to 5GHz Input level : 1.5Vp-p to 2.5Vp-p Input waveform : Sinusoidal wave (500M to 5GHz) or rectangular wave (10% to 90% of amplitude in 1ns or less) Impedance : 50Ω Connector : Precision N-type female
Pattern	Pseudo-random patterns (PRBS)	$2^N - 1$: N = 7, 9, 10, 11, 15*, 20, 23
	Programmable patterns	Data mode : Data length N: N = 2 to 16384 (64-bit step for N > 256) Word mode : Word length: 2 to 16 Number of words: 1 to 1024** Pattern memory : 10 different patterns (At turn-on, variable mark ratio pattern, of 1/2, 1/4 and 1/8 can be set in memory 0, 1, 2)***
	Logic reversal	Selectable positive or negative logic for PRBS and logic reversal for the above-mentioned pattern
	Gating	Inhibitable gating for the PRBS and programmable patterns with an external signal
Data output	DATA	Frequency range : 1.5GHz to 5GHz
	$\overline{\text{DATA}}$	Frequency range : 50MHz to 1.5GHz
	Amplitude	0.5Vp-p to 2Vp-p in 0.05V steps
	Offset	0V to ±2V in 0.05V steps
	Rise/fall time	70ps or less
	Load impedance	50Ω
	Connector	Precision N-type female
Clock output	CLOCK 1	Amplitude : Variable 0.5Vp-p to 2Vp-p in 0.05V steps Offset : Variable 0V to ±2V in 0.05V steps
	CLOCK 2	Amplitude : 2Vp-p ±10% (Fixed) Offset : 0V ±0.2V (Fixed)
	Rise/fall time	70ps or less
	Delay between CLOCK 1 and CLOCK 2	±500ps in 10ps steps
	Load impedance	50Ω
	Connector	Precision N-type female
Output phase		 However, variable delay is set at 0ps
Auxiliary output (Rear panel)	Number of bit rate	1/4 of clock frequency
	Number of pattern outputs	4
	Number of clock outputs	1
	Output level	1Vp-p (HIGH LEVEL 0 to −0.15V, LOW LEVEL −1 to −1.15V)
	Load impedance	50Ω
	Connector	BNC

Continued on next page.

(Continued)

Error insertion	Error rate	2×10^{-3}, 2×10^{-6}, single (manual)
Output data gating signal input	Input level	0/−1V
	Impedance	50Ω
	Rise/fall time	1ns or less
	Connector	BNC
Synchronous signal output	Pattern	1 system
	Clock	1 system of 1/16 of clock frequency signal
	Amplitude	0/−0.5V ±20%
	Load impedance	50Ω
	Connector	BNC
Remote control		GP-IB (IEEE Std. 488-1978) standard equipment
Power source		100V AC ±10%, 50/60Hz, ≦500VA
Dimensions and weight		221H, 426W, 450D mm, ≦35kg
Accessories		Power cord : 1pc. BNC cable : 2pc. 2m GP-IB cable : 1pc. 2m SMA cable : 2pc. 0.5m N-SMA converting plug : 5pc.

*For $2^{15}-1$ pattern, patterns conforming to CCITT O.151 and pattern from Anritsu 2G b/s pulse pattern generator are produced.
**Where the product "word length × number of words" should be 256 or more and can be divided by 64.
***1024-bit PRBS pattern

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
	Main frame		
MP1601A	Pulse Pattern Generator		
	Standard accessories		
J0133C	Coaxial cord, 2m:	2 pcs	BNC-P•RG-58A/U
	Semi-rigid cable, 0.5m:	2 pcs	SMA•—•SMA
J0008	GP-IB cable, 2m:	1 pc	408JE-102
J0323	Coaxial adaptor	5 pcs	N-P•SMA-J
J0017	Power cord, 2.5m	1 pc	
	MP1601A Operation manual:	1 copy	
	Optional accessories		
MB24A	Portable Test Rack Protective carrying case Transport bag Rack mount kit, 1MW•5U		
J0133	Coaxial cord, 1m		BNC-P•RG-58A/U•BNC-P
J0007	GP-IB cable, 1m		408JE-101

1/4 Demultiplexer
MP1603A

The MP1603A 1/4 Demultiplexer is a bit rate converter that can measure the error rate up to 5GHz by combining the Anritsu MP1601A 5G b/s pulse pattern generator, the ME522A measuring equipment receiver (with the Demultiplexer unit MH677A) and MS65A 2G b/s error detector.

Specifications

Data input	Operation frequency	1.4 GHz to 5GHz
	Pattern	Pseudo-random Mark ratio 1/2
	Waveform	NRZ
	Level	0.8 to 1.5V (50Ω) (AC coupled input)
1/4 clock input	Operation frequency	0.35 to 1.25GHz
	Waveform	Rectangular wave
	Level	0.8 to 1.5V (50Ω) (AC coupled input)
1/4 data output	Level	1.5V ± 0.3V (50Ω)
	Waveform	RZ
1/4 clock output	Level	1.5V ± 0.3V (50Ω)
Phase monitor output	Level	0.2V ± 0.1V (50Ω)
Phase adjustment		0 to 500ps
Power		AC **V ± 10%, 50/60Hz, ≦35VA
Dimensions and weight		88H, 426W, 450D mm, ≦9.5kg
Ambient temperature, rated range of use		0 to 50°C
Accessories supplied		One power cord One SMA cord (50Ω): 1m Three SMA cords (50Ω): 2m One SMA semi-rigid cable (50Ω): 1m Four N-SMA adaptors One BNC-SMA adaptor One delay cable set

**Specify one nominal line voltage between 100V and 250V when ordering.

Measurement

Figure 1 shows the connection when measuring the error rate. Figure 2 is the MP1603A block diagram. The MP1603A uses the MP1601A 1/4 clock as the input and generates sampling pulses of approximately 200ps (constant even when the frequency is varied) at the level conversion point of the 1/4 clock. These sampling pulses and the input high frequency data are applied to the AND circuit. As a result, the data sampled to one fourth is obtained at the output of the AND circuit and is stretched to the pulse width of approximately 500ps at the next stage.

The error rate can be measured up to 5G b/s by applying this 1/4 data output and 1/4 clock output to the ME522A/MH677A or MS65A input. However, the measurement pattern is restricted to a bit pseudo-random pattern. In addition, the optimum phase between the sampling pulses and data is adjusted by the phase adjustment knob while observing the phase monitor output as the waveform using the sampling oscilloscope.

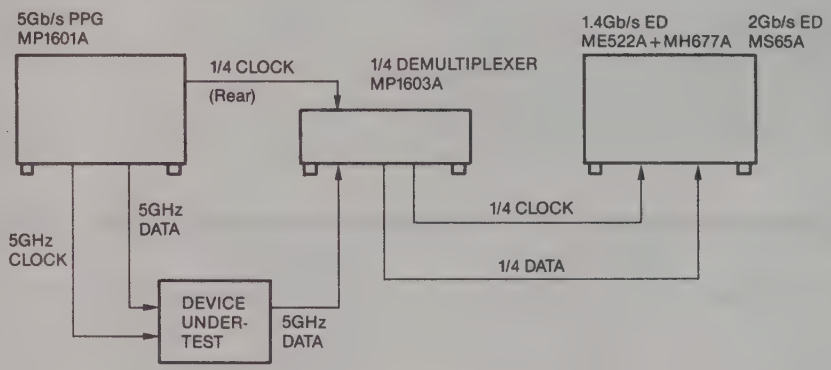


Fig. 1 5GHz Error Rate Measurement

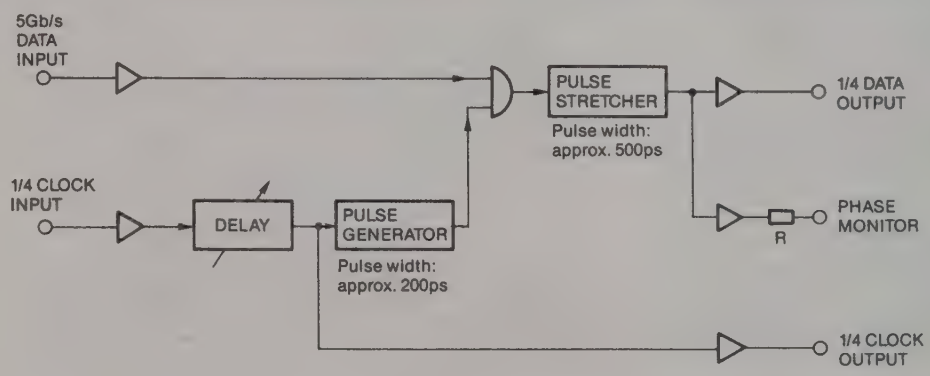


Fig. 2 MP1603A 1/4 Demultiplexer Block Diagram

Ordering information

Please specify model/order number, name and quantity when ordering.

Model number/ Order number	Name		Remarks
MP1603A	**Main frame** 1/4 Demultiplexer		
	Standard accessories		
	SMA cable, 1m:	1 pc	SMA•RG-58A/U•SMA
	SMA cable, 2m:	3 pcs	SMA•RG-58A/U•SMA
	SMA semi-rigid cable, 1m:	1 pc	SMA•UT-141A•SMA
	Delay cable	1 set	ℓ=5cm, ℓ=10cm, ℓ=20cm
	N-SMA adaptor	4 pcs	
	BNC-SMA adaptor	1 pc	
	Power cord	1 pc	
	Front cover	1 pc	
	Fuse for MP1603A, 0.5A:	6 pcs	T500mA250V
	MP1603A Operation Manual	1 copy	

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Printed in Japan 1987-9 50KL/M